**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 June 23, 2019

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

DATE OF MEETING June 23, 2019 LOCATION Kansas City, Missouri

| MEMBERS PRESENT | MEMBERS ABSENT | EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE |
|---|---|---|
| **VOTING MEMBERS** | | Jonell Watson |
| Jason Matteson | John Bean | Galen Gerig |
| Dustin Demetriou | Lex Coors | Han Xu |
| Ecton English | David Meadows | Shi Dantong |
| Gerardo Alfonso | Roger Schmidt | Hannah Huffmann |
| Donald Beaty | | |
| Jon Fitch | | |
| Mukesh Khattar | | |
| Christopher Muller | | |
| Terry Rodgers | | |
| Vali Sorell | | |
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| **CORRESPONDING MEMBERS** | | |
| John Groenewold | Raymond Abraham | |
| Robert McFarlane | Robert Akkerman | |
| Richard Pavlak | Stuart Aldridge | |
| Ahmed Abdel Salam | Husam Alissa | |
| Henry Amistadi | Matthew Archibald | |
| Brad Cochran | Serpil Ari | |
| Michael Collarin | Paul Artman | |
| Thomas Davidson | Rangarajan Arulselvan | |
| Benedict Dolcich | Sean Ashburn | |
| Michael Ellsworth | Robert Bader | |
| Paul Finch | William Bahnfleth | |
| Mark Fisher | Andrew Baxter | |
| David Grant | William Beck | |
| John Gross | Chad Beery | |

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| Hugh Hudson | Adenilson Belizario | |
| Gwenn Ivester | Paul Bemis | |
| Gary Johnson, Jr | Satyam Bendapudi | |
| David Kelley | Ng Kai Beng | |
| Matt Koukl | James Betts | |
| Elizabeth Langer | Michael Bishop | |
| Sang Lee | Byron Blackmore | |
| Michael Miller | Alonzo Blalock | |
| John O'Brien | Sébastien Brasseur | |
| Lawrence Ollice | Holly Brink | |
| John Peterson | Douglas Brown | |
| Joseph Prisco | Jerrod Buterbaugh | |
| Justin Seter | Tahir Cader | |
| Mark Seymour | Andrew Calder | |
| Saurabh Shrivastava | Aldo Calvi | |
| Matt Shumway | Nicholas Casale | |
| Mark Steinke | Noe Casalino | |
| Edward Tsui | John Castelvecchi | |
| Casey Winkel | Neil Chauhan | |
| John Groenewold | Sruti Chigullapalli | |
| Robert McFarlane | Dale Cibene | |
| Richard Pavlak | Alan Claassen | |
| Ahmed Abdel Salam | Fabio Clavijo | |
| Henry Amistadi | Benjamin Coe | |
| Brad Cochran | Dan Comperchio | |
| Michael Collarin | Howard Cooper | |
| Thomas Davidson | Bryce Cox | |
| Benedict Dolcich | James  Coyle | |
| Michael Ellsworth | Bryan Coyne | |
| Paul Finch | Craig Crader | |
| Mark Fisher | Matthew Cronmiller | |
| David Grant | Greg Crumpton | |
| John Gross | Bob Culver | |
| Hugh Hudson | Christopher Daniel | |
| Gwenn Ivester | Steve David | |
| Gary Johnson, Jr | George Degroft | |
| David Kelley | Cuong Dinh | |
| Matt Koukl | Bob Doherty | |
| Elizabeth Langer | Daniel Donahoe | |
| Sang Lee | Robert Druga | |
| Michael Miller | Aaron Duda | |
| John O'Brien | John Dumler | |
| Lawrence Ollice | Andrew Dunn | |
| John Peterson | Dan Dyer | |
| Joseph Prisco | Jacqueline Eaton | |
| Justin Seter | David Edenburn | |
| Mark Seymour | Michael Edie | |
| Saurabh Shrivastava | Dennis Eisenbarth | |
| Matt Shumway | Frank Erceg | |
| Mark Steinke | Hamza Erden | |

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|---|---|---|
| Edward Tsui | Maxwell Evans | |
| Casey Winkel | 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 | |
| | Troy Goldschmidt | |
| | Scott Graf | |
| | Shaun Green | |
| | Steve Greenberg | |
| | Charles Gulledge | |
| | Edward Gutowski | |
| | Kamel Haddad | |
| | Stephen Halsted | |
| | John Haney | |
| | Andrew Harrison | |
| | Kyle Hasenkox | |
| | Scot Heath | |
| | Dennis Hellmer | |
| | Magnus Herrlin | |
| | Robert Hewitt | |
| | Ted Hight | |
| | Elly Hiu | |
| | Kevin Hughes | |
| | Steven Hyde | |
| | Mark Hydeman | |
| | J C Ierschot | |
| | Hifumi Iguchi | |
| | Julian  Iosifescu | |
| | Madhusudan Iyengar | |
| | Charles Johnson | |
| | Rhonda Johnson | |
| | Alex Juncker | |
| | Alekhya Kaianathbhatta | |
| | George Kaler | |

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|---|---|---|
| | Rajendera Kapoor | |
| | Kailash Karki | |
| | Vijay Kasibhatla | |
| | Kanchan Kelkar | |
| | Daniel Kennedy | |
| | Michael Kester | |
| | Kishor Khankari | |
| | Richard Killian | |
| | William Kingrey | |
| | Marvin Kirshenbaum | |
| | Timothy Kittila | |
| | Erhard Klotz | |
| | Paul Knight | |
| | 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 | |
| | John Lanni | |
| | Jon Larry | |
| | Geoff Lawler | |
| | Matt Lawrence | |
| | Stuart Lawrence | |
| | Christian Le | |
| | Allan 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 | |
| | Guillermo Massucco | |
| | James McAleer | |

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|---|---|---|
| | Timothy McCann | |
| | Christopher McDermott | |
| | Jaakko McEvoy | |
| | Michael McKenna | |
| | Douglas McLellan | |
| | Godwyn Mendes | |
| | Francis Mills | |
| | Richie Mittal | |
| | Michael Monahan | |
| | Mark Monroe | |
| | Chad  Moore | |
| | David Moss | |
| | Stephen Mowrer | |
| | John Murgida | |
| | Ram Narayanamurthy | |
| | Philip Naughton | |
| | C.D Nayak | |
| | Ian Nelson | |
| | David Nesheiwat | |
| | John Neubauer | |
| | Michael Nicolai | |
| | Zuokui Ning | |
| | Budy Notohardjono | |
| | Shlomo Novotny | |
| | Mark Ogilvie | |
| | Michael Ohadi | |
| | Sean OHern | |
| | Shelley Ophir | |
| | Farid Parsaei | |
| | Chandrakant Patel | |
| | Mark Pavol | |
| | Andrew Pearson | |
| | Thomas Peddle | |
| | Tim Persoons | |
| | Craig Petersen | |
| | FLORIN POPA | |
| | Justin Prosser | |
| | Honore'du Puy | |
| | David Quirk | |
| | Prakash Rapolu | |
| | David Redford | |
| | Stuart Redshaw | |
| | Mark Reed | |
| | Gamal Refai-Ahmed | |
| | Charles Rego | |
| | William Reynolds | |
| | Steven Rosenstock | |
| | Joel Rutledge | |
| | Jeffrey Rutt | |
| | Hitoshi Sakamoto | |

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| | Nestor Salinas | |
| | Michael Salvatore | |
| | Peter Samain | |
| | Michael Schwarz | |
| | Michael Schwedler | |
| | Clifford Scofield | |
| | Ian Seaton | |
| | Darshit Shah | |
| | Anthony Sharp | |
| | Timothy Shedd | |
| | Ruben Sidranski | |
| | Thursten Simonsen | |
| | Mark Simpson | |
| | Shelby Sims | |
| | Satwinder Singh | |
| | Grant Smith | |
| | Stuart Smith | |
| | John Song | |
| | Marc Soucy | |
| | Ronald Spangler | |
| | Jonathan Spreeman | |
| | Mark Sprenger | |
| | Jeffrey Stein | |
| | 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 | |
| | Chad Tramonte | |
| | Jeff Trower | |
| | William Tschudi | |
| | Saahil Tumber | |
| | Marianna Vallejo | |
| | James VanGilder | |
| | Richard Velten | |
| | Herb Villa | |
| | David Vranish | |
| | Ralph Webb | |
| | Aaron Wemhoff | |
| | Andrew Wengerd | |

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|---|---|---|
| | Kurt Wetzel | |
| | Katherine Whitenack | |
| | Robert Wichert | |
| | Larry Wong | |
| | Tony S F Wong | |
| | Stephen Woollard | |
| | Eric  Yang | |
| | Yang Zou | |
| | Benjamin Zuk | |
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| **PROVISIONAL CORRESPONDING MEMBERS** | | |
| Nigel Gore | Antonio Aguayo | |
| Colin Laisure-Pool | Sajad Alimohammadi | |
| Benjamin Petschke | Mohammad Alkiswani | |
| Koarosh Nemati | Shawn Andrews | |
| | William Artis | |
| | Jakki Artus | |
| | George Augustini | |
| | James Benville | |
| | James Bogart | |
| | Rolf Brink | |
| | Wim Buters | |
| | David Chialastri | |
| | Brian Derby | |
| | DAVID DONGES | |
| | Dinesh Gupta | |
| | Mathias Hery | |
| | Chris Hsieh | |
| | Ming-Ren I | |
| | Roger Jones | |
| | Md Masud Karim | |
| | Gordon Keogh | |
| | Rehan Khalid | |
| | Srinivas  Kodea | |
| | Jayavant Kumar | |
| | Guy Majestic | |
| | Christopher Malone | |
| | Noreshvarman Manisagar | |
| | Carl Massey | |
| | Michael McRee | |
| | Salah Nezar | |
| | Leslye Paniagua | |
| | Mani Prakash | |
| | Suhasini Pyarasani | |
| | Anders Saksager | |
| | Angela Sampaio | |
| | Jimil Shah | |

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|---|---|---|
| | Annie Smith | |
| | Michael Streich | |
| | Micah Sweeney | |
| | SOON TATT | |
| | James Vallort | |
| | Kazuyuki Wakita | |
| | Darrin Watson | |
| | Malcolm White | |
| | Stephen Wren | |
| | Lixia Wu | |
| | Antonio Aguayo | |
| | Sajad Alimohammadi | |
| | Mohammad Alkiswani | |
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| | Lixia Wu | |
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**Published Agenda**

| Topic | | Time |
|---|---|---|
| Introduction | Welcome and around the room introductions | 10 |
| Programs | Kansas City & Orlando | 15 |
| Handbook Revision Update | Chapter 19 | 5 |
| Research | New RTAR Proposal, 1881-RTAR, Cold Weather Shipment and Subsequent Acclimation of Electronic Hardware | 5 |
| | 1675-RP : Guidance for CFD Modeling of Data Centers | 10 |
| | 1755-RP : Impact of Gaseous Contamination and High Humidity on IT Equipment Corrosion | 45 |
| | Energy Modeling Update | 10 |
| | Open Discussion on Future Research Topics | 10 |

Call to Order:1/13/19  5:00 PM Jason Matteson
- Introductions and Welcome
    - Programs handbook and research meeting
    - Jason Matteson Current Chair, Dustin Demetriou- Vice Chair
    - Around the room introductions
    - Recognition of first time guests
    - Sign-in sheet being passed
    - 2:15 to 7:00PM Monday meeting agenda announced.
    - Agenda for Sunday and Monday meetings is posted on TC 9.9 website.
    - Dustin Demetriou announced as next TC 9.9 Chair effective July 1.
- Programs – Terry Rodgers substituting for Nick Gangemi
    - No handouts but the presentation is available on the TC 9.9 website at http://tc0909.ashraetcs.org/documents/presentations/2019%20Kansas%20City%20Programs%20Update.pdf.
    - TC 9.9 Meetings at this conference
        - Conference Paper Session 2:  Presentation 2: Improving Data Center and Telecommunication System HVAC Design from Lessons Learned from Retro-Commissioning

- Different Types of Presentations at ASHRAE
- Upcoming Winter Conference
  - Orlando, FL | February 1-5, 2020
  - Hilton Orlando and Orange County Convention Center
  - AHRI Expo | Orange County Convention Center | Feb. 3-5
  - Eight (8) Tracks
    - HVAC&R Fundamentals and Applications
    - Systems and Equipment
    - Refrigeration and Refrigerants
    - Cutting Edge Approaches
    - High Efficiency Design and Operation
    - Big Data and Smart Controls
    - Ventilation, IAQ and Air Distribution Systems
    - Standards, Guidelines and Codes
  - Deadlines:
    - Monday, March 18, 2019: Conference Paper Abstracts, Technical Papers and Paper Session Requests Due
    - Monday, April 22, 2019: Conference Paper Abstract Accept/Reject Notifications
    - Monday, June 17, 2019: Website Opens for Seminar, Workshop, Forum, Debate, and Panel Proposals
    - Monday, July 8, 2019: Final Conference Papers Due - Submitted for Review (Includes Bio, Learning Objectives and Methods of Assessment); Request for Conference Paper Sessions Due
    - Friday, July 26, 2019: Conference Paper Accept/Revise/Reject Notifications
    - Friday, August 2, 2019: Seminar, Workshop, Forum, Debate, and Panel Proposals Due
    - Friday, August 9, 2019: Revised Conference Papers/Final Technical Papers Due
    - Friday, August 12, 2019: Conference Paper abstract or full Technical Papers Due
    - Friday, August 26, 2019: Conference and Technical Paper Final Accept/Reject Notifications
    - Friday, October 4, 2019: Seminar, Workshop, Forum, Debate, and Panel Accept/Reject Notifications
- TC members are encouraged to work through Nick when working

on ASHRAE presentation activities to help with acceptance success rate.
- o Contact Nick Gangemi, Program Chair | 585-721-8795 | ngangemi@primaryintegration.com
- o Panel on 90.1 and 90.4
  - ▪ Needed to fill out a panel for Orlando.  Bob McFarlene to follow-up.  Need a speaker for 90.1.
- o Dustin Demetriou informed the committee that there is now an "Extended Abstract submission type".  Short abstract that discusses research.  There were 70 submissions for Orlando and they are filling the slots in lieu of more traditional types.
- Handbook Revision Update – Bob McFarlene
  - o Handbook presentation is available on the TC 9.9 website at http://tc0909.ashraetcs.org/documents/presentations/2019%20Kansas%20City%20Applications%20Handbook%20Presentation.pdf
  - o 2019 HVAC Applications Handbook has been distributed to ASHRAE members.
  - o ASHRAE members now have online access to Handbooks due to the removal of CD distribution along with the print version of the Handbooks.
  - o Data Centers and Telecommunication Facilities chapter that was chapter 19 is now chapter 20 in the 2019 HVAC Applications Handbook.
  - o Chapter 20 had significant updates to include information from other Datacom series publications that are new or updated since last handbook publication.
  - o Summary of 2019 Revisions
    - ▪ Chapter Number Change from 19 to 20
    - ▪ eSociety Newsletter from April 17,2019 featured an article on the Chapter updates. https://www.ashrae.org/news/esociety/data-centers-telecommunications-facilities-handbook-chapter-updates
    - ▪ There is a link to the article on TC 9.9 LinkedIn page.
    - ▪ Added References for Datacom Series Books #12 & #13
      - • Server Efficiency – Metric for Computer Servers & Storage
      - • IT Equipment Design Impact on Data Center Solutions
    - ▪ Noted Updates to Three Datacom Series Books:
      - • "Thermal Guidelines", "Power Trends", and "Liquid

Cooling"
- Added Information on Standard 90.4
- Other Updates:
  - Reduced Emphasis on Raised Access Floors
  - Expanded Backup Power Section & Added LiON Batteries
  - Added Precautions Re: Exposure of Systems to Natural Disasters
  - Added Concerns About Hi-Density Hard Disk Exposure to Vibration & Gas Discharge
  - Added Information on LED and PoE-Driven Lighting for Data Centers
  - Expanded Information on TGG PoE & WUE Metrics
  - Expanded Information on Economizers, and Added Refrigerant-side Economizers
- New Handbook Update Timeline was discussed:
  - Year 1 | 7/2019 – 6/2020 | Full Review of Newly Published Chapter | Proposed Revision Summary to Handbook Publications
  - Year 2 | 7/2020 – 6/2021 | Major Section Re-Drafts & Board Review | Out-of-Sequence Updates (On-Line Version Only)
  - Year 3 | 7/2021 – 6/2022 | Revision Completion & TC Board Approval | Probably Requires Letter Ballot.  Should Not Wait Until Jan.
  - Year 4 | 7/2022 – 6/2023 | Handbook Submission & Gallery Proof Review | Our Board Approval Will Probably be Late 2022
- Bob encouraged members to go through the newly published chapter and make notes about things that need to be changed or corrected.  Also any suggestions for the next edition.
- Board will be pre-approving major chapter updates.
- Also submission can be made for out of sequence updates online.
- 
- Research – Dustin Demetriou
  - General Discussion on ASHRAE Research
    - Co-funding for ASHRAE research projects with outside organizations such as manufacturers.
    - Currently 59 active research projects.

- $10.6 million of total value.
- On average the research projects are $160,000.
- 18-24 month during projects.
- 907 projects with a combined value of $76 million since 1959.
- General link to research is on the ASHRAE website under Technical Resources/Research
- There is a flowchart showing the research submittal and approval process.
- Dustin reviewed the process with the committee.
- Need to ask, "How does the research we are proposing fit in with the overall research strategic guideline?"
- Research liaison is Paolo Tronville for section 9.
- We currently have no new research projects being developed from TC 9.9.
- Research is always much stronger when it is co-sponsored with another TC.
- Mark Seymour is to become the new Research Committee chair on July 1, 2019.
- Mark's e-mail is mark.seymour@futurefacilities.com.
  - 1755 RP: Impact of Gaseous Contamination and High Humidity on IT Equipment Corrosion - Dustin Demetriou
    - Funded in 2017.
    - Final report has been submitted to the PMS.
    - After final report is approved by the PMS it will go to TC 9.9 for approval by the voting members.
    - Review of results in Monday's IT subcommittee meeting run by Dustin and will be made open.
    - Presentation of results summary by guest speakers Rui Zhang and Jensen Zhang at end of Research portion of meeting.
  - 1675 RP: Guidance for CFD Modeling of Data Centers - Mark Seymour
    - TC 4.10 research project that TC 9.9 is the co-sponsor.
    - Awarded to Florida International University.
    - Unfortunately, FIU's laboratory was determined to be unacceptable and this had led to considerable delays.
    - Laboratory portion was subcontracted to Georgia Tech in Atlanta.
    - No cost extension to March of 2020.
    - Work is moving forward and there are hints of the research

will end up being useful.
- We do not anticipate a results presentation at the January meeting but maybe next summer.
  - New RTAR Proposal, 1881-RTAR, Cold Weather Shipment and Subsequent Acclimation of Electronic Hardware
    - Roger Schmidt originally proposed.
    - Co-funding has been offered by IT equipment manufacturers.
    - It was rejected by RAC.  Comments are expected.
    - There was a discussion speculating on the reasons for the rejection.
    - Plan to discuss with Steve Comstock.
  - Energy Modeling Update- Henry Amistadi
    - Vali Sorell is to develop a table of contents for the white paper.
    - Vali is looking at identifying the issues that are unique to data center energy modeling and provide guidance.
    - Vali is expecting to have the TOC done by the Orlando meeting.
    - Contact Vali if you are interested in contributing to his portion of this effort.
    - Henry Amistadi is to continue the work on the modeling algorithms.
    - Henry is using a free version of the commercial software Mathcad (Mathcad Express) for development and documentation purposes.

- Open Forum/Wrap up


7:00 PM Meeting Concluded

# 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_____June 24, 2019___

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

DATE OF MEETING_____June 24, 2019_____LOCATION___Kansas City, Missouri__

| MEMBERS PRESENT | MEMBERS ABSENT | EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE |
|---|---|---|
| **VOTING MEMBERS** | | |
| Jason Matteson | John Bean | Jonell Watson |
| Dustin Demetriou | Lex Coors | Galen Gerig |
| Ecton English | Roger Schmidt | Sean Faltermeier |
| Gerardo Alfonso | | Ted Wayne |
| Donald Beaty | | Mark Adams |
| Jon Fitch | | Goo Tianyi |
| David Meadows | | Mark Siira |
| Mukesh Khattar | | Kevin Connor |
| Christopher Muller | | |
| Terry Rodgers | | |
| Vali Sorell | | |
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| **CORRESPONDING MEMBERS** | | |
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| Richard Pavlak | Stuart Aldridge | |
| Ahmed Abdel Salam | Husam Alissa | |
| Henry Amistadi | Matthew Archibald | |
| Brad Cochran | Serpil Ari | |
| Michael Collarin | Paul Artman | |
| Thomas Davidson | Rangarajan Arulselvan | |
| Benedict Dolcich | Sean Ashburn | |
| Michael Ellsworth | Robert Bader | |
| Paul Finch | William Bahnfleth | |
| Mark Fisher | Andrew Baxter | |
| Kevin Gebke | William Beck | |
| Arthur Giesler | Chad Beery | |
| David Grant | Adenilson Belizario | |
| John Gross | Paul Bemis | |
| Hugh Hudson | Satyam Bendapudi | |

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|---|---|---|
| Gwenn Ivester | Ng Kai Beng | |
| Gary Johnson, Jr | James Betts | |
| David Kelley | Michael Bishop | |
| Matt Koukl | Byron Blackmore | |
| Elizabeth Langer | Alonzo Blalock | |
| Sang Lee | Sébastien Brasseur | |
| Guillermo Massucco | Holly Brink | |
| Michael Miller | Douglas Brown | |
| Ian Nelson | Jerrod Buterbaugh | |
| John O'Brien | Tahir Cader | |
| Lawrence Ollice | Andrew Calder | |
| Mark Pavol | Aldo Calvi | |
| John Peterson | Nicholas Casale | |
| Joseph Prisco | Noe Casalino | |
| Justin Seter | John Castelvecchi | |
| Mark Seymour | Neil Chauhan | |
| Saurabh Shrivastava | Sruti Chigullapalli | |
| Matt Shumway | Dale Cibene | |
| Mark Steinke | Alan Claassen | |
| Casey Winkel | Fabio Clavijo | |
| John Groenewold | Benjamin Coe | |
| Robert McFarlane | Dan Comperchio | |
| Richard Pavlak | Howard Cooper | |
| Ahmed Abdel Salam | Bryce Cox | |
| Henry Amistadi | James  Coyle | |
| Brad Cochran | Bryan Coyne | |
| Michael Collarin | Craig Crader | |
| Thomas Davidson | Matthew Cronmiller | |
| Benedict Dolcich | Greg Crumpton | |
| Michael Ellsworth | Bob Culver | |
| Paul Finch | Christopher Daniel | |
| Mark Fisher | Steve David | |
| Kevin Gebke | George Degroft | |
| Arthur Giesler | Cuong Dinh | |
| David Grant | Bob Doherty | |
| John Gross | Daniel Donahoe | |
| Hugh Hudson | Robert Druga | |
| Gwenn Ivester | Aaron Duda | |
| Gary Johnson, Jr | John Dumler | |
| David Kelley | Andrew Dunn | |
| Matt Koukl | Dan Dyer | |
| Elizabeth Langer | Jacqueline Eaton | |
| Sang Lee | David Edenburn | |
| Guillermo Massucco | Michael Edie | |
| Michael Miller | Dennis Eisenbarth | |
| Ian Nelson | Frank Erceg | |
| John O'Brien | Hamza Erden | |
| Lawrence Ollice | Maxwell Evans | |
| Mark Pavol | Jeffrey Ewin | |
| John Peterson | Huang Feng | |

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| Joseph Prisco | Gregory Fennewald | |
| Justin Seter | Philip Flinn | |
| Mark Seymour | Sophia Flucker | |
| Saurabh Shrivastava | Clayton Foster | |
| Matt Shumway | Kamran Fouladi | |
| Mark Steinke | David Franczak | |
| Casey Winkel | Michael Frank | |
| John Groenewold | Terry Frantzis | |
| Robert McFarlane | Charles Freda | |
| Richard Pavlak | F French | |
| Ahmed Abdel Salam | Paul Galloway | |
| Henry Amistadi | Hongwen Gao | |
| Brad Cochran | Rajat Ghosh | |
| Michael Collarin | John Gideon | |
| Thomas Davidson | Robin Gilbert | |
| Benedict Dolcich | Kenneth Gill | |
| Michael Ellsworth | Troy Goldschmidt | |
| Paul Finch | Scott Graf | |
| Mark Fisher | Shaun Green | |
| Kevin Gebke | Steve Greenberg | |
| Arthur Giesler | Charles Gulledge | |
| David Grant | Edward Gutowski | |
| John Gross | Kamel Haddad | |
| Hugh Hudson | Stephen Halsted | |
| Gwenn Ivester | John Haney | |
| Gary Johnson, Jr | Andrew Harrison | |
| David Kelley | Kyle Hasenkox | |
| Matt Koukl | Scot Heath | |
| Elizabeth Langer | Dennis Hellmer | |
| Sang Lee | Magnus Herrlin | |
| Guillermo Massucco | Robert Hewitt | |
| Michael Miller | Ted Hight | |
| Ian Nelson | Elly Hiu | |
| John O'Brien | Kevin Hughes | |
| Lawrence Ollice | Steven Hyde | |
| Mark Pavol | Mark Hydeman | |
| John Peterson | J C Ierschot | |
| Joseph Prisco | Hifumi Iguchi | |
| Justin Seter | Julian  Iosifescu | |
| Mark Seymour | Madhusudan Iyengar | |
| Saurabh Shrivastava | Charles Johnson | |
| Matt Shumway | Rhonda Johnson | |
| Mark Steinke | Alex Juncker | |
| Casey Winkel | Alekhya Kaianathbhatta | |
| | George Kaler | |
| | Rajendera Kapoor | |
| | Kailash Karki | |
| | Vijay Kasibhatla | |
| | Kanchan Kelkar | |
| | Daniel Kennedy | |

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| | Michael Kester | |
| | Kishor Khankari | |
| | Richard Killian | |
| | William Kingrey | |
| | Marvin Kirshenbaum | |
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| | Erhard Klotz | |
| | Paul Knight | |
| | 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 | |
| | John Lanni | |
| | Jon Larry | |
| | Geoff Lawler | |
| | Matt Lawrence | |
| | Stuart Lawrence | |
| | Christian Le | |
| | Allan 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 | |
| | James McAleer | |
| | Timothy McCann | |
| | Christopher McDermott | |
| | Jaakko McEvoy | |
| | Michael McKenna | |
| | Douglas McLellan | |
| | Godwyn Mendes | |

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| | Richie Mittal | |
| | Michael Monahan | |
| | Mark Monroe | |
| | Chad  Moore | |
| | David Moss | |
| | Stephen Mowrer | |
| | John Murgida | |
| | Ram Narayanamurthy | |
| | Philip Naughton | |
| | C.D Nayak | |
| | David Nesheiwat | |
| | John Neubauer | |
| | Michael Nicolai | |
| | Zuokui Ning | |
| | Budy Notohardjono | |
| | Shlomo Novotny | |
| | Mark Ogilvie | |
| | Michael Ohadi | |
| | Sean OHern | |
| | Shelley Ophir | |
| | Farid Parsaei | |
| | Chandrakant Patel | |
| | Andrew Pearson | |
| | Thomas Peddle | |
| | Tim Persoons | |
| | Craig Petersen | |
| | FLORIN POPA | |
| | Justin Prosser | |
| | Honore'du Puy | |
| | David Quirk | |
| | Prakash Rapolu | |
| | David Redford | |
| | Stuart Redshaw | |
| | Mark Reed | |
| | Gamal Refai-Ahmed | |
| | Charles Rego | |
| | William Reynolds | |
| | Steven Rosenstock | |
| | Joel Rutledge | |
| | Jeffrey Rutt | |
| | Hitoshi Sakamoto | |
| | Nestor Salinas | |
| | Michael Salvatore | |
| | Peter Samain | |
| | Michael Schwarz | |
| | Michael Schwedler | |
| | Clifford Scofield | |
| | Ian Seaton | |
| | Darshit Shah | |

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| | Anthony Sharp | |
| | Timothy Shedd | |
| | Ruben Sidranski | |
| | Thursten Simonsen | |
| | Mark Simpson | |
| | Shelby Sims | |
| | Satwinder Singh | |
| | Grant Smith | |
| | Stuart Smith | |
| | John Song | |
| | Marc Soucy | |
| | Ronald Spangler | |
| | Jonathan Spreeman | |
| | Mark Sprenger | |
| | Jeffrey Stein | |
| | 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 | |
| | Chad Tramonte | |
| | Jeff Trower | |
| | William Tschudi | |
| | Edward Tsui | |
| | Saahil Tumber | |
| | Marianna Vallejo | |
| | James VanGilder | |
| | Richard Velten | |
| | Herb Villa | |
| | David Vranish | |
| | Ralph Webb | |
| | Aaron Wemhoff | |
| | Andrew Wengerd | |
| | Kurt Wetzel | |
| | Katherine Whitenack | |
| | Robert Wichert | |
| | Larry Wong | |
| | Tony S F Wong | |
| | Stephen Woollard | |
| | Eric  Yang | |

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| | Yang Zou | |
| | Benjamin Zuk | |
| | Wangda Zuo | |
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| **PROVISIONAL CORRESPONDING MEMBERS** | | |
| Nigel Gore | Antonio Aguayo | |
| Roger Jones | Sajad Alimohammadi | |
| Colin Laisure-Pool | Mohammad Alkiswani | |
| Benjamin Petschke | Shawn Andrews | |
| Koarosh Nemati | William Artis | |
| | Jakki Artus | |
| | George Augustini | |
| | James Benville | |
| | James Bogart | |
| | Rolf Brink | |
| | Wim Buters | |
| | David Chialastri | |
| | Brian Derby | |
| | DAVID DONGES | |
| | Dinesh Gupta | |
| | Mathias Hery | |
| | Chris Hsieh | |
| | Ming-Ren I | |
| | Md Masud Karim | |
| | Gordon Keogh | |
| | Rehan Khalid | |
| | Srinivas  Kodea | |
| | Jayavant Kumar | |
| | Guy Majestic | |
| | Christopher Malone | |
| | Noreshvarman Manisagar | |
| | Carl Massey | |
| | Michael McRee | |
| | Salah Nezar | |
| | Leslye Paniagua | |
| | Mani Prakash | |
| | Suhasini Pyarasani | |
| | Anders Saksager | |
| | Angela Sampaio | |
| | Jimil Shah | |
| | Annie Smith | |
| | Michael Streich | |

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| | Micah Sweeney | |
| | SOON TATT | |
| | James Vallort | |
| | Kazuyuki Wakita | |
| | Darrin Watson | |
| | Malcolm White | |
| | Stephen Wren | |
| | Lixia Wu | |
| | Antonio Aguayo | |
| | Sajad Alimohammadi | |
| | Mohammad Alkiswani | |
| | Shawn Andrews | |
| | William Artis | |
| | Jakki Artus | |
| | George Augustini | |
| | James Benville | |
| | James Bogart | |
| | Rolf Brink | |
| | Wim Buters | |
| | David Chialastri | |
| | Brian Derby | |
| | DAVID DONGES | |
| | Dinesh Gupta | |
| | Mathias Hery | |
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| | Ming-Ren I | |
| | Md Masud Karim | |
| | Gordon Keogh | |
| | Rehan Khalid | |
| | Srinivas  Kodea | |
| | Jayavant Kumar | |
| | Guy Majestic | |
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| | Noreshvarman Manisagar | |
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| | Suhasini Pyarasani | |
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## Published Agenda

| Topic | Subtopic | Time |
| --- | --- | --- |
| Introduction | Welcome and around the room introductions | 10 |
| | Who is TC9.9 | 10 |
| | TC9.9 Officers & Membership | 10 |
| Webmaster | | 5 |
| Liaison Reports | Standard 90.1 | 10 |
| | Standard 90.4 Review | 10 |
| | SPC-127 | 5 |
| | AHRI 1360 | 5 |
| | International | 5 |
| Marketing subcommittee | Update | 5 |
| | Break | 15 |
| Industry Engagements | 7x24 Exchange Texas Southern Chapter | 5 |
| | Open Compute Platform (OCP) | 10 |
| Publications | Datacom Book #3: Design Considerations for Datacom Equipment Centers | 10 |
| | Datacom Book #14 : DCIM | 5 |
| | Liquid Cooling Pressor | 5 |
| | Water Cooling Whitepaper | 5 |
| | HDD Whitepaper | 5 |
| IT Subcommittee Reports | | 60 |
| | Liquid Cooling Whitepaper | |
| | IEC/ASHRAE | |
| Executive Session - | Voting Members | 20 |

Call to Order: 7/24/19  2:15 PM Jason Matteson

## Introduction – Jason Matteson

- HVAC Applications handbook is out and our chapter is now chapter 20.
- Review of topics covered in Sunday night meeting; Programs, Handbook and Research.  These topics will not be repeated on Monday evening

meetings.
- Newcomers recognized.
- Introductions (all attendees in the room).
- ASHRAE Code of Ethics reviewed.
- Reviewed ASHRAE background slides
- TC 9.9 Overview deck is on the TC 9.9 website at
  http://tc0909.ashraetcs.org/documents/presentations/ASHRAE_TC0909_Introduction_and_Overview_09_Jan_2019.pdf
- New 14th Datacom book is now in the bookstore covering DCIM.
- Discussion of TC membership status and process
  - July 1st is the date when the roster is updated (Provisional to Corresponding member).
  - TC 9.9 is the largest technical committee
- Introduced Dustin Demetriou as next Chair of the technical committee.
- Review of Officers (as of July 1, 2019)

| Position | Name |
|---|---|
| Chair | Dustin Demetriou |
| Vice Chair | John Groenewold |
| Secretary | Matt Kouki |
| 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 |

- Membership Update
  - 378 members as of May 29, 2019.
  - 48 of those members are provisional corresponding members.
  - 330 are full corresponding members.
  - 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 dropped from the roster.
  - Encourage members to use my profile to update e-mail addresses especially if your job changes.
  - E-mail blast was sent out prior to the meeting.  If e-mail bounced back then the person was removed from the roster.

- o If you were removed and it was due to an out-of-date email please contact the Chair.
  - o You can join through the TC 9.9 website using the "Join" button.
- Voting Members
  - o Must be made up of corresponding members and have been an active corresponding member for at least one year.
  - o Consists of an average of 12, minimum of 6 and a maximum of 18.
  - o Shall be appointed annually by the chair for not more than 4 consecutive one year terms.
  - o 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.
  - o Currently 14 voting members but will be going to 15 as of July 1st.
    - Jason Matteson
    - Dustin Demetriou
    - Chris Muller
    - Jon Fitch
    - Mukesh K Khattar
    - Don Beaty
    - Vali Sorell
    - Terry Rodgers
    - Ecton English
    - John Bean
    - Roger Schmidt
    - Lex Coors
    - Dave Meadows
    - Alfonso Gerardo
  - o Voting members as of July 1, 2019 (shown on website but not presented):
    - Dustin Demetriou
    - Matt Koukl
    - Ecton English
    - Gerardo Alfonso
    - John Bean
    - Donald Beaty
    - Lex Coors
    - John Gross
    - David Kelley
    - David Meadows

- David Moss
- Christopher Muller
- Terry Rodgers
- Roger Schmidt
- Vali Sorell
  - Roster update will go into effect on July 1st, 2019 just after the Kansas City conference.
- General
  - Update on recent past votes:
    - Water-cooled Server Whitepaper - Approved
    - Atlanta Meeting Minutes – Approved by Committee
    - HDD Whitepaper – Approved by Committee
    - Cold Shipping RTAR – Approved by Committee (rejected by RAC)
  - Chair and Vice-Chair meet with ASHRAE leadership early on 6:30 am on Sunday morning of the conference.
    - Proposal to reorganize the Task Force groups.
      - Affects TCs, TGs, MTGs, and TRGs
      - Attempt to prevent overlap between those groups and committees and drive efficiencies.
      - Trying to make sure that these meetings do not overlap other ASHRAE conference activities and prevent members from attending.
      - Dave Kelley organized the feedback to the proposal to reorganize.
      - Leadership is shifting focus from trying to merge a number of the TCs together and instead just try to optimize.
      - Presentations in the morning and technical meetings in the afternoons.
      - Functional heads will work to find some possible mergers of TCs.
    - New ASHRAE Strategic Plan discussion
      - The Strategic Plan presentation is available on the ASHRAE website.
      - Mission: To serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration and their allied fields.
      - Vision: A healthy and sustainable built environment for

all.

**Website Update – Jason Matteson substituting for Ecton English**
- Tc0909.ashraetcs.org
- We will be using e-mail responses to assist in determining which members are continuing to be involved.
- Kansas City Agenda posted on website.
- There is a Join button under the membership tab.

**Programs Update – Terry Rodgers substituting for Nick Gangemi**
- Programs presentation is posted on the website.
  - Missing one date: August 12, 2019 Deadline for submission of the conference paper abstract or the full technical paper.
- Nick Gangemi is now with Primary Integration and his e-mail has changed to ngangemi@primaryintegration.com.

**Liaison Reports**
- Standard 90.1 – Rick Pavlak
  - Closing up addendums for 2016 standard.
  - Document will go to publication in October.
  - Addendum BV – removed PUE tables and replaced with standard 90.4.
  - 90.4 is now a standing committee.
  - 90.1-2019 data center compliance path will integrate 90.4.
- Standard 90.4 Review – Dave Kelley
  - Standing Committee with updates to standard every three years with addendums in between.
  - Addendums A-G went out for public review and will be incorporated in 2019 standard.  These will be published in the October timeframe.
  - Addendums included MLC and ELC values lowered to make it more stringent.
  - Looking at how to take advantage of taking credit for using waste data center heat but will not be in the 2019 standard.  Expect an addendum in the next 6-9 months.
  - Looking to get standard recognized by the ICC.
    - Submitted for Spring meeting but not accepted.
    - The submission will be revised and ASHRAE will continue to comment in support of adoption.

- - Finally vote will be in the October meetings.
    - Pass in 2019 and it will be 2023 for AHJ adoption.
    - If it fails to be adopted by ICC in October we hope that ICC will adopt the newest version of 90.1 that incorporates 90.4 as a compliance path.
  - Requested a list of states that have adopted. Adopted by Washington with variations.
  - Talk with Jeff Sloan about adoption in the state of Washington.
  - 25, 50, 75, and 100% load annualized MLC is now included.
  - Design MLC has been removed.
- SPC-127 – John Bean (not present and therefore no update)
- AHRI 1360 – Dave Kelley
  - Rating standard for data center cooling equipment.
  - Started about the same time as 90.4.
  - Multiple revisions have taken place.
  - Last publication was in 2017 where ceiling and floor mounted equipment was incorporated.
  - AHRI has been undergoing a lot of reorganization and it is believed that this has hurt efforts in this standard.
  - Incorporating more equipment into the standard per request from the DOE. Equipment that has been marketed for use in data centers.
    - Rooftop units sold into data center applications could be included.
    - Wall mounted units could be included.
  - We want to improve the efficiency metric to more accurately reflect data center environment. Should be year-round annualized figures by climate zone to reflect how the equipment is utilized.
  - Feds have 1 ½ years to address any changes. Missed 2016 version. 2016 was never incorporated.
  - 90.1 committee has worked hard with the Feds to incorporate numbers in 90.1-2019 version. Hopefully in a year and a half those will be incorporated. Still looking at 2022 or so before numbers show up in the federal register.
  - May depend on the outcome of 2020 elections.
- GPC 1.6 Data Center Commissioning Guidelines – Terry Rodgers
  - Standing committee SPC 300 controls commissioning guidelines and standards.
  - Will follow the basic flow of commissioning standard 202 which is a

minimum standard.
- o Newest is GPC 1.6 data center commissioning guidelines. Been approved in committee and in process of being developed.
- o GPC 1.6 is intended to be a guideline and a best practices document.
- o Supplemental to ASHRAE guideline 0 – The Commissioning Process.
- o Looking for feedback from TC 9.9 on what we believe the specific needs are in the data center industry that is outside of the existing guidelines.
- o Looking for volunteers to be on the committee. Pass along request to colleagues.
- o Covers new construction and existing facilities.
- Section Head – Vance Pain
  - o TAC = Technical Activities Committee
  - o Certificate of Appreciation given to Jason Matteson.
  - o Might see some condensing down of TCs by the time of the Austin meetings.
  - o Asked TC 9.9 to think about who we might be able to absorb.
- International – Paul Finch substituting for Don Beaty
  - o EU commission is now focused on data centers.
  - o Data center industry is being targeted because of the amount of energy they are consuming.
  - o Reached out to ASHRAE in 2015 as they were drafting new regulations on storage and server equipment. And specifically they reached out to TC 9.9.
  - o Thermal Guidelines were misunderstood by the EU commission and are still largely misunderstood in the EU.
  - o EU commission looked at the impact of servers from creation to end-of-life and determined they had their highest impact during operation.
  - o Three primary areas the EU was focused on:
    - § Power supply unit
    - § Idle state power
    - § How the units came together
  - o TC 9.9 was invited to attend and present at the EU commission.
  - o Paul was along for the presentation along with others from Digital Realty and Global Switch.
  - o Facilities and IT manufacturers were all getting more energy

efficient.
- o Roger Schmidt led things from an IT perspective.
- o There was a risk of having a different set of thermal guidelines adopted in the EU.
- o Regulation formalized and adopted in March and the Thermal Guidelines were referenced.
- o Thermal Guidelines could now be considered as part of the regulatory environment.
- o The reference was only to the table and footnotes including rate of change were not referenced.
- o There are concerns that the regulations will not be able to keep up with changes in the Thermal Guidelines.
- o Looking for opportunities to gain awareness around Thermal Guidelines.
    - ▪ techUK ITTEA
    - ▪ EUDCA – Industry Body (European Data Centre Association).
- o As a business in the EU, you cannot go straight to the EU commission and instead you must be represented at EU through an industry body.
- o ASHRAE European Region XIV launched in July 2017.
    - ▪ London chapter
    - ▪ Dublin chapter
    - ▪ Madrid chapter
- o Steve Comstack is now based in Brussels in the role of ASHRAE business manager for Europe.
- o Mark Seymour presented at the Madrid ASHRAE chapter and has been asked to speak at the Portuguese chapter.

**Marketing Subcommittee – Paul Finch**
- LinkedIn site launched last year.
- 315 followers on LinkedIn account of TC 9.9.
- Water-Cooled whitepaper was announced on LinkedIn.

**Other**
- TC2.3 on Gaseous Contaminates is interested in seminar on the Use and effectiveness of gas phase filtration in data centers.

**Industry Engagements**
- Open Compute Platform (OCP) – Nigel Gore

- o Founded in 2011 by Facebook, Rackspace and Intel.
- o 195 founding members
- o Goldman Sachs is a member.
- o Workshops and summits held every year.
- o There is a products recognitions program.
- o Advanced Cooling Solutions (ACS) workgroup focused on liquid cooling technologies
  - ▪ Cold plate
  - ▪ Integrated rack manifold
  - ▪ Rear door heat exchangers
  - ▪ Immersion Cooling
- o Basic membership is around $1000 per annum.
- TC 1.4 Cybersecurity – Ecton English
  - o Multidisciplinary task force on Cybersecurity.
  - o Looking for a vote of support from TC 9.9.
  - o How does this fit into this TC? DCIM and control cybersecurity concerns.
  - o Wants to produce a guideline on cybersecurity.
  - o BACnet standard TC is reaching out for a meeting to discuss.
  - o ISA 62443 standard on control system components.
- 7x24 Exchange Texas South Chapter

**Publications**
- Datacom Book #3: Design Considerations for Datacom Equipment Centers – Larry Ollice
  - o Book is done.
  - o Been working on book for two and a half years.
  - o All chapters are complete.
  - o Appendix A was dropped due to redundancy with Thermal Guidelines.
  - o Started as a minor refresh but ended up being a major rewrite.
  - o Submitted to Don Beaty and the subcommittee (Rodger and Don).
  - o Will next go to a vote by TC 9.9.
  - o Expect to be done by Winter meeting.
  - o Need to get it done by September to get it published by Winter meeting.
  - o Things need to be adjusted for ASHRAE print standards.
- HDD Whitepaper – Matt Shumway
  - o Focusing on the impact of increased sensitivities of hard drive

storage.
- o Concerns the vibrations caused by the cooling fans in the server and the performance/impact on hard drives.
- o Hard drives are more sensitive and there are bigger and bigger fans in equipment.
- o Proofs signed off on last week.
- o 16 pages long.
- o New blast will come out through LinkedIn account and will be available on the website for download.
- Datacom Book #14: DCIM – Mark Steinke and Dustin Demetriou
  - o New in June 2019 and is now available in the bookstore.
  - o Not yet available online as of the meeting date but will check on future availability.
  - o There was an article in the ASHRAE Journal that highlighted the publication of the book.
- Thermal Guidelines (recorded out of sequence with presentation)
  - o Spanish version is now available.
  - o Announced on LinkedIn TC 9.9 account.

## IT Subcommittee – Mark Steinke and Dustin Demetriou
- Liquid Cooling Whitepaper
  - o Need for education in water cooling in data centers was highlighted.
  - o Noted the speed to which the industry is now adopting water cooling.
  - o Put out a teaser on liquid cooling and was made available on the TC 9.9 website addressing "why liquid now?" available at http://tc0909.ashraetcs.org/documents/ASHRAE_TC0909_Liquid_Cooling_White_Paper_Brief_2_April_2019.pdf
  - o Full Liquid Cooling Whitepaper is now available on the TC 9.9 website at http://tc0909.ashraetcs.org/documents/ASHRAE_TC0909_Water_Cooled_Servers_11_April_2019.pdf
  - o Reviewed a presentation on the whitepaper that was presented to the EEHPC committee.
  - o Focused on the practice, parts and materials involved in liquid cooling.
  - o Addressed direct and indirect water cooling systems.
  - o Addressed filtration and water quality issues.
  - o Pressure testing requirements are also addressed.

- o Wet break and dry break connections covered.
- IEC/ASHRAE
  - o An update to the IEC standard requiring 5 times operating pressure test had a lot of pushback.
  - o IEC moved from 5x to a 3x standard and now with TC 9.9 engagement, we are urging a 1.5x test.
  - o Also needed more definition on failure types.

## Executive Session – Jason Matteson
- Not Held