



**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 13, 2019

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

DATE OF MEETING January 13, 2019 LOCATION Atlanta, Georgia

Note: These draft 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 |
|------------------------------|-----------------------|--|
| VOTING MEMBERS | | Shawn Andrews |
| Jason Matteson | Ecton English | Reza Ghias |
| Dustin Demetriou | Lex Coors | Nigel Gore |
| Gerardo Alfonso | Mukesh Khattar | Marcus Hansen |
| John Bean | | Benjamin Petsche |
| Donald Beaty | | Douglas Sick |
| Jon Fitch | | Darrin Watson |
| David Meadows | | Rui Zhang |
| Christopher Muller | | |
| Terry Rodgers | | |
| Roger Schmidt | | |
| Vali Sorell | | |
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| CORRESPONDING MEMBERS | | |
| John Groenewold | Raymond Abraham | |
| Robert McFarlane | Robert Akkerman | |
| Joseph Gangemi | Robert Akkerman | |
| Richard Pavlak | Stuart Aldridge | |
| Jack Glass | Henry Amistadi | |
| Paul Artman | Rangarajan Arulselvan | |
| Michael Collarin | Sean Ashburn | |
| Paul Finch | Robert Bader | |
| Arthur Giesler | William Bahnfleth | |
| David Grant | Andrew Baxter | |

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| Steve Greenberg | William Beck | |
| John Gross | Chad Beery | |
| Hugh Hudson | Ng Kai Beng | |
| David Kelley | James Betts | |
| Matt Koukl | James Betts | |
| Nemat Lotfi | Michael Bishop | |
| David Moss | Byron Blackmore | |
| Shlomo Novotny | Alonzo Blalock | |
| John O'Brien | Sébastien Brasseur | |
| Lawrence Ollice | Tahir Cader | |
| Christian Pastrana | Aldo Calvi | |
| John Peterson | Nicholas Casale | |
| Justin Seter | Noe Casalino | |
| Mark Seymour | John Castelvechi | |
| Vali Sorell | Neil Chauhan | |
| Mark Steinke | Dale Cibene | |
| David Tootle | Alan Claassen | |
| Marianna Vallejo | Fabio Clavijo | |
| | Dan Comperchio | |
| | Howard Cooper | |
| | James Coyle | |
| | Craig Crader | |
| | Matthew Cronmiller | |
| | Bob Culver | |
| | Christopher Daniel | |
| | Steve David | |
| | Thomas Davidson | |
| | George Degroft | |
| | Bob Doherty | |
| | Daniel Donahoe | |
| | Robert Druga | |
| | John Dumler | |
| | Andrew Dunn | |
| | Dan Dyer | |
| | Michael Edie | |
| | Dennis Eisenbarth | |
| | Michael Ellsworth | |
| | Frank Erceg | |
| | Jeffrey Ewin | |
| | Huang Feng | |
| | Gregory Fennewald | |
| | Philip Flinn | |
| | Kamran Fouladi | |
| | Michael Frank | |
| | Terry Frantzis | |
| | F French | |
| | Paul Galloway | |
| | Hongwen Gao | |
| | Kevin Gebke | |
| | Rajat Ghosh | |

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| | John Gideon | |
| | Robin Gilbert | |
| | Kenneth Gill | |
| | Charles Gulledge | |
| | Edward Gutowski | |
| | Kamel Haddad | |
| | Stephen Halsted | |
| | John Haney | |
| | Andrew Harrison | |
| | Kyle Hasenkox | |
| | Scot Heath | |
| | Dennis Hellmer | |
| | Magnus Herrlin | |
| | Ted Hight | |
| | Elly Hiu | |
| | Kevin Hughes | |
| | Mark Hydeman | |
| | J C Ierschot | |
| | Gwenn Ivester | |
| | Madhusudan Iyengar | |
| | Charles Johnson | |
| | Rhonda Johnson | |
| | Alex Juncker | |
| | George Kaler | |
| | Rajendera Kapoor | |
| | Kailash Karki | |
| | 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 | |
| | Christopher Kurkjian | |
| | Osmo Kuusisto | |
| | Stephen Lahti | |
| | David Landsberg | |
| | John Lane | |
| | Federico Lang | |
| | John Lanni | |
| | Jon Larry | |
| | Geoff Lawler | |
| | Matt Lawrence | |

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| | Stuart Lawrence | |
| | Christian Le | |
| | Sang Lee | |
| | Bret Lehman | |
| | Frank Lembo | |
| | Guillermo Leon Orellana | |
| | Hsing-Sheng Liang | |
| | Mike Licitra | |
| | Francis Allen Lumabas | |
| | Lu Luna | |
| | William Maltz | |
| | Alessandro Mandelli | |
| | Lawrence Markel | |
| | Ted Marwitz | |
| | Caroline Mason | |
| | Guillermo Massucco | |
| | James McAleer | |
| | Timothy McCann | |
| | Michael McKenna | |
| | Douglas McLellan | |
| | Godwyn Mendes | |
| | Francis Mills | |
| | Richie Mittal | |
| | Michael Monahan | |
| | Mark Monroe | |
| | Stephen Mowrer | |
| | John Murgida | |
| | Ram Narayanamurthy | |
| | Philip Naughton | |
| | C.D Nayak | |
| | David Nesheiwat | |
| | John Neubauer | |
| | Michael Nicolai | |
| | Budy Notohardjono | |
| | Mark Ogilvie | |
| | Michael Ohadi | |
| | Chandrakant Patel | |
| | Mark Pavol | |
| | Andrew Pearson | |
| | Craig Petersen | |
| | Joseph Prisco | |
| | Honore'du Puy | |
| | David Quirk | |
| | David Redford | |
| | Mark Reed | |
| | Gamal Refai-Ahmed | |
| | Charles Rego | |
| | William Reynolds | |
| | Steven Rosenstock | |
| | Joel Rutledge | |

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| | Jeffrey Rutt | |
| | Nestor Salinas | |
| | Michael Salvatore | |
| | Peter Samain | |
| | Michael Schwarz | |
| | Michael Schwedler | |
| | Clifford Scofield | |
| | Ian Seaton | |
| | Darshit Shah | |
| | Anthony Sharp | |
| | Timothy Shedd | |
| | Saurabh Shrivastava | |
| | Thursten Simonsen | |
| | Mark Simpson | |
| | Shelby Sims | |
| | Satwinder Singh | |
| | Grant Smith | |
| | John Song | |
| | Marc Soucy | |
| | Ronald Spangler | |
| | Ronald Spangler | |
| | Jonathan Spreeman | |
| | Jeffrey Stein | |
| | Robin Steinbrecher | |
| | Morgan Stevens | |
| | Charles Stewart | |
| | Robert Sullivan | |
| | 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 VanGilder | |
| | Richard Velten | |
| | Herb Villa | |
| | Ralph Webb | |
| | Andrew Wengerd | |
| | Kurt Wetzel | |
| | Katherine Whitenack | |
| | Robert Wichert | |
| | Larry Wong | |

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| | Tony S F Wong | |
| | Stephen Woollard | |
| | Wangda Zuo | |
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| PROVISIONAL CORRESPONDING MEMBERS | | |
| Benedict Dolcich | Ahmed Abdel Salam | |
| DAVID DONGES | Antonio Aguayo | |
| Mark Fisher | Husam Alissa | |
| Steven Hyde | Mohammad Alkiswani | |
| Gary Johnson, Jr | Matthew Archibald | |
| Mark Malkin | Serpil Ari | |
| Mark Monroe | William Artis | |
| Ian Nelson | Jakki Artus | |
| Kourosch Nemati | Adenilson Belizário | |
| Stuart Redshaw | Paul Bemis | |
| Kazuynki Wakita | Satyam Bendapudi | |
| Casey Winkel | James Benville | |
| | James Bogart | |
| | Holly Brink | |
| | Douglas Brown | |
| | Jerrold Buterbaugh | |
| | Andrew Calder | |
| | David Chialastri | |
| | Sruti Chigullapalli | |
| | Brad Cochran | |
| | Benjamin Coe | |
| | Bryce Cox | |
| | Bryan Coyne | |
| | Greg Crumpton | |
| | Shelley Dangoor | |
| | Cuong Dinh | |
| | Aaron Duda | |
| | Jacqueline Eaton | |
| | David Edenburn | |
| | Hamza Erden | |
| | Maxwell Evans | |
| | Sophia Flucker | |
| | Clayton Foster | |
| | David Franczak | |
| | Charles Freda | |
| | Troy Goldschmidt | |
| | Scott Graf | |
| | Shaun Green | |
| | Dinesh Gupta | |
| | Mathias Hery | |
| | Robert Hewitt | |
| | Chris Hsieh | |
| | Ming-Ren I | |
| | Hifumi Iguchi | |

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| | Julian Iosifescu | |
| | Alekhya Kaianathbhatta | |
| | Vijay Kasibhatla | |
| | Rehan Khalid | |
| | Srinivas Kodea | |
| | Yuichi Kurihashi | |
| | Yiu Wa Kwan | |
| | Yuk Kuen Lam | |
| | Yuk Kuen Lam | |
| | Elizabeth Langer | |
| | Allan Lee | |
| | Guy Majestic | |
| | William Mak | |
| | Noreshvarman Manisagar | |
| | Carl Massey | |
| | Christopher McDermott | |
| | Jaakko McEvoy | |
| | Michael Miller | |
| | Chad Moore | |
| | Salah Nezar | |
| | Zuokui Ning | |
| | Sean OHern | |
| | Denis O'Mahony | |
| | Leslye Paniagua | |
| | Farid Parsaei | |
| | Thomas Peddle | |
| | Tim Persoons | |
| | FLORIN POPA | |
| | Justin Prosser | |
| | Suhasini Pyarasani | |
| | Prakash Rapolu | |
| | Hitoshi Sakamoto | |
| | Angela Sampaio | |
| | Andres Sepúlveda | |
| | Matt Shumway | |
| | Ruben Sidranski | |
| | Annie Smith | |
| | Stuart Smith | |
| | Susan Smith | |
| | Mark Sprenger | |
| | Robert Sty | |
| | Kaiyu Sun | |
| | Micah Sweeney | |
| | SOON TATT | |
| | James Vallort | |
| | David Vranish | |
| | Aaron Wemhoff | |
| | Stephen Wren | |
| | Eric Yang | |

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| | Yang Zou | |
| | Benjamin Zuk | |

Published Agenda

TC 9.9 Programs, Handbook and Research – GWCC, 3rd Floor, Building A, A301

| Topic | | Time | Presenter |
|---------------------------------|---|------|------------------|
| Introduction | Welcome and around the room introductions | 10 | Jason Matteson |
| Programs | Atlanta & Kansas City | 15 | Nick Gangemi |
| Handbook Revision Update | Chapter 19 | 5 | Bob McFarlane |
| Research | 1675-RP : Guidance for CFD Modeling of Data Centers | 15 | Mark Seymour |
| | 1755-RP : Impact of Gaseous Contamination and High Humidity on IT Equipment Corrosion | 45 | Dustin Demetriou |
| | Energy Modeling Update | 15 | Vali Sorell |

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
 - Next meeting to be Kansas City for the Summer Conference
 - Sign-in sheet being passed
 - 2:15 to 7:00PM Monday meeting
 - Agenda for Sunday and Monday meetings is posted on TC 9.9 website.
- Membership List Discussion
 - As part of an effort to clean up the TC membership rolls all members were sent an e-mail to verify their information. If the e-mail delivery failed the member was removed. Sixty-five (65) people were removed from the rolls as a result.
 - If name does not appear on the attendance list and you may have been removed. If this is in error please contact Jason Matteson.
 - Members were encouraged to keep their e-mail up-to-date on the ASHRAE website to prevent any future issues.
 - Code of Ethics review.
- Program Update- Nick Gangemi
 - No handouts but the information is available on the TC 9.9 website.
 - Review of sponsored events at the winter conference.
 - 90% success rate on submissions being accepted.

- Review of number of papers submitted versus number that are approved.
- Review of the different types of submittals.
- Kansas City, June 22-26 is the next conference.
- Extension has been granted for some submittals for Kansas City.
- Deadline of Feb. 8th is the critical deadline for us with respect to KC.
- March 15 deadline for conference papers summary for Orlando.
- Need papers and reviewers
- Contact Nick.gangemi6@gmail.com
- Handbook Revision Update – Bob McFarlane
 - HVAC Applications handbook is due for a new published version this year (4 year rotation, last one came out on 2014).
 - Last revision was a total rewrite and keyed to the Datacom book series.
 - Out of sequence updates are in the online version.
 - There were so many volunteers that not everyone was utilized.
 - A new version was submitted for the 2019 version.
 - Bob is currently waiting on proofs.
 - Out of sequence updates were automatically included in the 2019 version.
 - Roger Schmidt had the final review of the submittal.
 - The last out of sequence update took two years due to technical and bureaucratic issues.
 - The out of sequence updates can take place at any time.
- Research
 - 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 University in Atlanta.
 - Subcontract with GT has been signed.
 - Kickoff meeting with FIU, GT and members of the PMS has occurred at the GT laboratory.
 - FIU has been sourcing some server simulators and work put in by PMS to make sure the server simulators work like real servers with respect to pressure drop and heat load.
 - Prototype server simulator airflow could not be turned down

enough to simulate a real server. This has since been resolved and new version works much better.

- New server simulators have better fan control with the ability to turn individual fans off. Questions about recirculation with fans off remain.
 - FIU has surveyed the GT laboratory and has been building the computer models.
 - Airflow tiles that were donated are now on-site. These are higher airflow, more free area airflow tiles with a lower pressure drop compared with the existing tiles.
 - There was a payment issue with the server simulators that was resolved.
 - Remaining units have reportedly been manufactured and are being tested for quality assurance.
 - Once the server simulators have been received we should be in a position to start the laboratory portion of the work.
 - FIU is currently building the first model. Simulations will be performed first to identify the test scenarios that we want to perform in the lab.
 - We are currently in a no-cost extension period until the end of March 2019.
 - PMS has agreed to request another one year no-cost extension.
- 1755 RP: Impact of Gaseous Contamination and High Humidity on IT Equipment Corrosion - Dustin Demetriou
 - TC 9.9 is the lead sponsor.
 - No cost extension was granted until December 31, 2019
 - Will be coming to a close this year.
 - Probable review of results in detail at the summer meeting.
 - PMS meeting Monday morning, 7:30-9:00 am.
 - Overview of the project presented.
 - Final draft of the results is being reviewed by the PMS.
 - RTAR (Research Topic Acceptance Request) 1867: Development of a Model for assessing corrosion risk of datacom equipment. – Dustin Demetriou
 - RTAR was submitted to RAC (Research Activities Committee) and was rejected.
 - Reasons for rejection:
 - RAC could not tell what the difference was between the proposed project and 1755-RP.

- RAC also wanted to see 1755-RP come to a close and be reviewed by the PMS before investing any more money into additional research on the topic.
 - We will revisit after the conclusion of 1755-RP.
- General – Dustin Demetriou
 - No new research projects from TC 9.9 have been proposed and nothing new is currently in the pipeline.
 - Ideas on research should be sent to Dustin
 - Authors of any RTAR are allowed to bid on the project but they cannot write the work statement.
 - Work statements are written by the committee after the RTAR has been approved.
- Energy Modeling Update- Vali Sorell
 - There has been little progress since the last meeting.
 - Review of history of the effort.
 - Originally intended to provide guidance on the necessary energy calculations needed for compliance with ASHRAE Standard 90.4.
 - Currently available commercial energy calculation software is not set up for the data center environment and is difficult to adapt.
 - Working on recommended methods for energy calculations.
 - Create outline/table of contents is first priority.
 - Henry Amistadi wants work on implementation based on standard mathematical notation and has started creating models in Mathcad.
 - The Mathcad model would become the basis of a whitepaper.
 - Henry wants to move away from the use of spreadsheets due to the difficulty in dealing with the coding and formulas.
- Open Forum/Wrap up
 - Henry Amistadi offered the idea of putting together a compilation of articles and whitepapers as a special publication.

6:19 PM Meeting Concluded

TC/TG/MTG/TRG MINUTES COVER SHEET

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TC/TG/MTG/TRG No. TC 9.9 DATE January 14, 2019

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

DATE OF MEETING January 14, 2019 LOCATION Atlanta, Georgia

| MEMBERS PRESENT | MEMBERS ABSENT | EX-OFFICIO MEMBERS AND ADDITIONAL ATTENDANCE |
|------------------------------|-----------------------|--|
| VOTING MEMBERS | | Roy Fraley |
| Jason Matteson | Ecton English | Nigel Gore |
| Dustin Demetriou | Lex Coors | Benjamin Petsche |
| Gerardo Alfonso | | Douglas Sick |
| John Bean | | Darrin Watson |
| Donald Beaty | | Rui Zhang |
| Jon Fitch | | Mikhail Gorbonnov |
| Mukesh Khattar | | Marija Stefanovic |
| David Meadows | | Dan McInnis |
| Christopher Muller | | Anh Tran |
| Terry Rodgers | | Adam Smith |
| Roger Schmidt | | Hoshi Daruwalla |
| Vali Sorell | | Galen Gerig |
| | | Farah Singer |
| | | Fabio Battaglia |
| | | John Petronyolo |
| | | Michael McRee |
| | | Cheng-Xian Lin |
| | | |
| CORRESPONDING MEMBERS | | |
| John Groenewold | Raymond Abraham | |
| Robert McFarlane | Robert Akkerman | |
| Joseph Gangemi | Robert Akkerman | |
| Richard Pavlak | Stuart Aldridge | |
| Jack Glass | Henry Amistadi | |
| Paul Artman | Rangarajan Arulselvan | |
| John Dumler | Sean Ashburn | |
| Dan Dyer | Robert Bader | |
| Paul Finch | William Bahnfleth | |
| Kevin Gebke | Andrew Baxter | |
| Arthur Giesler | William Beck | |
| David Grant | Chad Beery | |
| Steve Greenberg | Ng Kai Beng | |
| John Gross | James Betts | |

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| Hugh Hudson | James Betts | |
| Kevin Hughes | Michael Bishop | |
| David Kelley | Byron Blackmore | |
| Matt Koukl | Alonzo Blalock | |
| Christopher Kurkjian | Sébastien Brasseur | |
| Nemat Lotfi | Tahir Cader | |
| David Moss | Aldo Calvi | |
| Shlomo Novotny | Nicholas Casale | |
| John O'Brien | Noe Casalino | |
| Lawrence Ollice | John Castelvechi | |
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| John Peterson | Dale Cibene | |
| David Quirk | Alan Claassen | |
| Joel Rutledge | Fabio Clavijo | |
| Justin Seter | Michael Collarin | |
| Mark Seymour | Dan Comperchio | |
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| Jeffrey Stein | James Coyle | |
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| | Huang Feng | |
| | Gregory Fennewald | |
| | Philip Flinn | |
| | Kamran Fouladi | |
| | Michael Frank | |
| | Terry Frantzis | |
| | F French | |
| | Paul Galloway | |
| | Hongwen Gao | |
| | Rajat Ghosh | |
| | John Gideon | |
| | Robin Gilbert | |
| | Kenneth Gill | |
| | Charles Gullledge | |
| | Edward Gutowski | |
| | Kamel Haddad | |

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| | Stephen Halsted | |
| | John Haney | |
| | Andrew Harrison | |
| | Kyle Hasenkox | |
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| | Dennis Hellmer | |
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| | Madhusudan Iyengar | |
| | Charles Johnson | |
| | Rhonda Johnson | |
| | Alex Juncker | |
| | George Kaler | |
| | Rajendera Kapoor | |
| | Kailash Karki | |
| | 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 | |
| | Osmo Kuusisto | |
| | Stephen Lahti | |
| | David Landsberg | |
| | John Lane | |
| | Federico Lang | |
| | 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 | |

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| | Francis Allen Lumabas | |
| | Lu Luna | |
| | William Maltz | |
| | Alessandro Mandelli | |
| | Lawrence Markel | |
| | Ted Marwitz | |
| | Caroline Mason | |
| | Guillermo Massucco | |
| | James McAleer | |
| | Timothy McCann | |
| | Michael McKenna | |
| | Douglas McLellan | |
| | Godwyn Mendes | |
| | Francis Mills | |
| | Richie Mittal | |
| | Michael Monahan | |
| | Mark Monroe | |
| | Stephen Mowrer | |
| | John Murgida | |
| | Ram Narayanamurthy | |
| | Philip Naughton | |
| | C.D Nayak | |
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| | Craig Petersen | |
| | Joseph Prisco | |
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| | Mark Reed | |
| | Gamal Refai-Ahmed | |
| | Charles Rego | |
| | William Reynolds | |
| | Steven Rosenstock | |
| | Jeffrey Rutt | |
| | Nestor Salinas | |
| | Michael Salvatore | |
| | Peter Samain | |
| | Michael Schwarz | |
| | Michael Schwedler | |
| | Clifford Scofield | |
| | Ian Seaton | |
| | Darshit Shah | |
| | Anthony Sharp | |

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| | Timothy Shedd | |
| | Saurabh Shrivastava | |
| | Thursten Simonsen | |
| | Mark Simpson | |
| | Shelby Sims | |
| | Satwinder Singh | |
| | Grant Smith | |
| | John Song | |
| | Marc Soucy | |
| | Ronald Spangler | |
| | Ronald Spangler | |
| | Jonathan Spreeman | |
| | Robin Steinbrecher | |
| | Morgan Stevens | |
| | Charles Stewart | |
| | Robert Sullivan | |
| | David Sundin | |
| | Jacob Svenkeson | |
| | Inn Tang | |
| | Edwin Teoh | |
| | Jeff Tepler | |
| | Ronald Thomas | |
| | Russell Tipton | |
| | Sengul Topuz | |
| | Robert Tozer | |
| | Chad Tramonte | |
| | Jeff Trower | |
| | William Tschudi | |
| | Saahil Tumber | |
| | Marianna Vallejo | |
| | Richard Velten | |
| | Herb Villa | |
| | Ralph Webb | |
| | Andrew Wengerd | |
| | Kurt Wetzel | |
| | Katherine Whitenack | |
| | Robert Wichert | |
| | Larry Wong | |
| | Tony S F Wong | |
| | Stephen Woollard | |
| | Wangda Zuo | |
| PROVISIONAL CORRESPONDING MEMBERS | | |
| Aaron Wemhoff | Aaron Duda | |
| Ahmed Abdel Salam | Adenilson Belizário | |
| Benedict Dolcich | Alekhya Kaianathbhatta | |
| Benjamin Coe | Allan Lee | |
| Brad Cochran | Andres Sepúlveda | |
| Casey Winkel | Andrew Calder | |
| Charles Freda | Angela Sampaio | |

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| Chris Hsieh | Annie Smith | |
| DAVID DONGES | Antonio Aguayo | |
| Gary Johnson, Jr | Benjamin Zuk | |
| Ian Nelson | Bryan Coyne | |
| James Bogart | Bryce Cox | |
| Kazuynki Wakita | Carl Massey | |
| Mark Fisher | Chad Moore | |
| Mark Malkin | Christopher McDermott | |
| Mark Monroe | Clayton Foster | |
| Micah Sweeney | Cuong Dinh | |
| Rehan Khalid | David Chialastri | |
| Steven Hyde | David Edenburn | |
| Stuart Redshaw | David Franczak | |
| | David Vranish | |
| | Denis O'Mahony | |
| | Dinesh Gupta | |
| | Douglas Brown | |
| | Elizabeth Langer | |
| | Eric Yang | |
| | Farid Parsaei | |
| | FLORIN POPA | |
| | Greg Crumpton | |
| | Guy Majestic | |
| | Hamza Erden | |
| | Hifumi Iguchi | |
| | Hitoshi Sakamoto | |
| | Holly Brink | |
| | Husam Alissa | |
| | Jaakko McEvoy | |
| | Jacqueline Eaton | |
| | Jakki Artus | |
| | James Benville | |
| | James Vallort | |
| | Jerrold Buterbaugh | |
| | Julian Iosifescu | |
| | Justin Prosser | |
| | Kaiyu Sun | |
| | Kourosh Nemati | |
| | Leslye Paniagua | |
| | Mark Sprenger | |
| | Mathias Hery | |
| | Matt Shumway | |
| | Matthew Archibald | |
| | Maxwell Evans | |
| | Michael Miller | |
| | Ming-Ren I | |
| | Mohammad Alkiswani | |
| | Noreshvarman Manisagar | |
| | Paul Bemis | |
| | Prakash Rapolu | |

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|--|---------------------|--|
| | Robert Hewitt | |
| | Robert Sty | |
| | Ruben Sidranski | |
| | Salah Nezar | |
| | Satyam Bendapudi | |
| | Scott Graf | |
| | Sean OHern | |
| | Serpil Ari | |
| | Shaun Green | |
| | Shelley Dangoor | |
| | SOON TATT | |
| | Sophia Flucker | |
| | Srinivas Kodea | |
| | Sruti Chigullapalli | |
| | Stephen Wren | |
| | Stuart Smith | |
| | Suhasini Pyarasani | |
| | Susan Smith | |
| | Thomas Peddle | |
| | Tim Persoons | |
| | Troy Goldschmidt | |
| | Vijay Kasibhatla | |
| | William Artis | |
| | William Mak | |
| | Yang Zou | |
| | Yiu Wa Kwan | |
| | Yuichi Kurihashi | |
| | Yuk Kuen Lam | |
| | Yuk Kuen Lam | |
| | zay zay | |
| | Zuokui Ning | |

Published Agenda

| Topic | | Time | Presenter |
|-------------------------------|---|------|-----------------|
| Introduction | Welcome and around the room introductions | 10 | Jason Matteson |
| | Who is TC9.9 | 10 | Jason Matteson |
| | TC9.9 Officers & Membership | 10 | Jason Matteson |
| Recognition | | 5 | Jason Matteson |
| Webmaster | | 5 | Ecton English |
| Liaison Reports | Standard 90.1 | 10 | Rick Pavlack |
| | Standard 90.4 Review | 10 | Dave Kelley |
| | SPC-127 | 5 | John Bean |
| | AHRI 1360 | 5 | Dave Kelley |
| | DMTF Redfish | 5 | Jason Matteson |
| | International | 5 | Don Beaty |
| Marketing Subcommittee | Update | 5 | Paul Finch |
| Break | | | |
| Industry Engagements | Department of Energy Update | 10 | Steve Greenberg |

| | | | |
|--------------------------------|---|-----|------------------|
| | Fuel Cell workshop at NREL | 5 | Dave Moss |
| | EU Regulation and ASHRAE Journal Article | 10 | Paul Finch |
| Publications | Datacom Book #3: Design Consideration for Datacom Equipment Centers | 15 | Larry Ollice |
| | Datacom #14: DCIM | 5 | Dustin Demetriou |
| IT Subcommittee Reports | | 90 | Roger Schmidt |
| | Liquid Cooling Whitepaper | | Mark Steinke |
| | HDD Whitepaper | | Matt Shumway |
| | Cold Shipping Requirements | | Joe Prisco |
| | Liquid Cooling in CoLos | | Dave Moss |
| | IEC/ASHRAE | | Roger Schmidt |
| Executive Session | Voting Members | TBD | Jason Matteson |

Call to Order: 1/14/19 2:08 PM Jason Matteson

Introduction – Jason Matteson

- Review of topics covered in Sunday night meeting; Programs, Handbook and Research.
- Introductions
- 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
- Review of ASHRAE Code of Ethics
- ASHRAE & TC 9.9 Overview
- Review of Officers

| Position | Name |
|-------------------------------|------------------|
| Chair | Jason Matteson |
| Vice Chair | Dustin Demetriou |
| Secretary | John Groenewold |
| IT Subcommittee Chair | Roger Schmidt |
| Handbook Subcommittee Chair | Robert McFarlane |
| Program Subcommittee Chair | Nick Gangemi |
| Standards Subcommittee Chair | Richard Pavlak |
| Membership Subcommittee Chair | Jack Glass |
| Webmaster | Ecton English |

- Membership Update
 - We are the largest TC at more than 400 members.
 - Roster review and removal of those whose e-mail failed and bounced back. Sixty-five (65) people were removed from the rolls as

a result.

- 106 Provisional Corresponding Members (2 years to be provisional and to become active in the TC).
- 239 Corresponding Members (can be voting members and elected to become officers).

- Voting Members

- Must be made up of corresponding members and have been an active corresponding member for at least one year.
- Consists of an average of 12, minimum of 6 and a maximum of 18.
- Shall be appointed annually by the chair for not more than 4 consecutive one year terms.
- Number of voting members required to be present to conduct business or a quorum is more than half of the number of voting members.
- Current Voting members:
 - Jason Matteson
 - Dustin Demetriou
 - Ecton English
 - Gerardo Alfonso
 - John Bean
 - Don Beaty
 - Lex Coors
 - Jon Fitch
 - Mukesh Khattar
 - David Meadows
 - Christopher Muller
 - Terry Rodgers
 - Roger Schmidt
 - Vali Sorell
- Roster update will go into effect on July 1st, 2019 just after the Kansas City conference.
- Record of votes for 2018:

| Vote | Date | Approved |
|---------------------------|---------|----------|
| St. Louis Meeting Minutes | January | Yes |
| Chicago Meeting Minutes | April | Yes |
| Corrosion Risk RTAR* | July | Yes |

| | | |
|------------------------------------|---------------|-----|
| HVAC Handbook : Chapter 19 | October | Yes |
| Houston Meeting Minutes | November | Yes |
| DCIM Datacom Book #14 | December | Yes |
| Water Cooled Servers Whitepaper | January ('19) | Yes |

- Operating Manual for Chairs requires meeting minutes to be voted out and timeframes for agenda.
- Potential Technical Committee Reorganization
 - TAC would like to reduce the number of functional group meetings.
 - Concern about all the meetings that are overlapping with the conference presentations that people are paying for.
 - Target to reduce the number from 110 to 30 technical working groups.
 - Looking for feedback to give TAC by end of next week and there is a form to be filled out.
 - This might mean that some other committees might get pulled into our committee.
 - Don Beaty is encouraging some of the smaller, less active committees to become virtual.
 -

Webmaster – Jason Matteson substituting for Ecton English

- Tc0909.ashraetcs.org
- Encourage members to use my profile to update e-mail addresses.
- Atlanta Agenda posted on website.
- There is a Join button under the membership tab.

Recognition – Jay Kohler

- Presented Hightower Award to David Moss.
- Given once a year given to a member of a TG/TC for outstanding service.

Handbook Chapter Update – Bob McFarlane

- TC 9.9 is responsible for Chapter 19 of the HVAC Applications Handbook

Liaison Reports

- Standard 90.1 – Rick Pavlak
 - Dozens of addendums being published.
 - 2016 was the last publication
 - It takes years for the model code to be adopted by ICC and then by the individual states.
 - Three things going on with the 90.1 committee in Atlanta
 - Addendum BV – Fall of 2018, public review closed in November. Going out as a second public review.
 - Addendum CZ is dead.
 - Get updated by getting registered on the list-server.
 - Rick was pleased with the language of BV that will make 90.4 an alternative path for data centers.
 - Section 8 of 90.1 will have 90.4 integrated into its language.
 - Addendum BE, update to the computer room equipment table vetted by AHRI. It is expected to be approved.
 - Changing the Title, Purpose and Scope of 90.1. Unknown what this means to the data center world. Change is open for comment. Exact wording is not public yet.
 - News concerning these addendums will be posted to the TC 9.9 website.
- Standard 90.4 Review – Dave Kelley
 - Education efforts about 90.4 continue.
 - Washington state is in the process of adopting chapters 6 & 8 with lower MLC numbers than what is in the standard today.
 - WA adoption would go into effect in 2020.
 - Only two weather zones are in the state of Washington so those are the only MLC numbers they had to adjust.
 - Two meetings in Atlanta on 90.4
 - Three new addendums voted out and will be available first half of the year.
 - ELC numbers change based on UPS efficiencies numbers.
 - Elimination of the design MLC
 - Lower the MLC for all climate zones plus created two MLC numbers with a breakpoint based on the size of the load in the room at 300 kW.
 - Optional compliance path with a pure prescriptive path if using a VAV system with an air-cooled economizer.
 - Talked about educating the general public but need to educate ASHRAE on what 90.4 is all about.

- Seminar and a panel session in Kansas City around 90.4.
- New standard is due to be published this Fall.
- Spanish article on 90.4 was published in region 12.
- 90.4 is being embedded into the compliance flowchart in 90.1.
- AHRI 1360 – Dave Kelley
 - Last year ceiling units were added into the standard.
 - In Houston, AHRI proposed new efficiency numbers to 90.1 for floor mount units and new numbers for ceiling mount units.
 - Member of DOE on 90.1 that was ok with ceiling units because they were new and had nothing to compare but believed they were backsliding on the floor mounted units from what was already in the federal register and 90.1-2010.
 - Numbers were submitted and were voted out with the promise to work with the DOE over the summer.
 - Last day of comment period, proposed new numbers that everyone and the DOE were happy with.
 - Those new numbers were voted out today and will be in the new 90.1- 2019.
 - Numbers for in-row cooling units were also updated from what appeared in 90.1-2016 but were not previously in the federal register.
 - DOE is supposed to react within 18 months of the publication of 90.1 and either use the new numbers or create their own numbers.
 - Current numbers in the federal register are from 90.1-2012.
 - We expect the DOE to adopt the new numbers and put them in the federal register to go into effect by 2021.
- SPC-127 – John Bean
 - Method of Test for Air-Conditioners serving data centers and technology equipment.
 - 2nd draft is now ready and has been through SPLS and all the votes are in.
 - It will be out for public review again on Jan. 18, 2019.
 - Was specific to CRAC units has now been expanded to a larger market of the equipment serving data centers.
 - Now the standard encompasses all equipment that actually takes energy out of the air.
 - Only system that is not covered is direct evaporative systems because they don't actually take energy out of the air.
 - Indirect evaporative air systems are covered.
 - Method of test is based on the return air temperature as some tables of what should be used for outside air wet bulb and dry bulb

temperatures.

- DMTF Redfish – Jason Matteson
 - Open Industry Standard Schema
 - RESTFUL API that allows for communication between different pieces of equipment.
 - Getting widespread adoption.
 - Distributed Management Task Force (DMTF)
 - Task Force is where the work takes place.
 - The task force/working group has been taking up all things DCIM.
 - ASHRAE TC 9.9 wanted to have a liaison in the working group.
 - We are actively involved in a weekly working group to drive the standards for DCIM down to the IT level.
 - Should greatly open up the ability for the user to get information from the IT equipment.
 - Over 40+ sensors that will be included.
 - All this will be included in a 2018.3 schema that has been released.
 - PowerPoint presented will be available on the website.
- Comment on Publications – Don Beaty
 - ASHRAE has been too slow to market with the graphics so we have that prepared.
 - PDF version is color but the hard copy is black and white and many times it does not translate well.
 - We do the rework faster than what ASHRAE would normally do.
 - Every week that we delay past Sept. 1st greatly increases the possibility it will not be published for the winter.
 - Getting something published for the summer is not nearly as critical.
 - We try to stay away from whitepapers because the books have more credibility in our eyes.
- International – Don Beaty
 - Lots going on in Japan, Europe and Spain.
 - Gerardo Alfonso has translated the Thermal Guidelines book to Spanish.
 - The book was submitted by November.
 - Spanish version of the Thermal Guidelines will be ready in March/April.
 - European Commission – Paul Finch
 - European Commission was looking to legislate around server efficiency.
 - Paul and Roger Schmidt met with EU representatives about the Thermal Guidelines and IT server efficiency.

- Thermal Guidelines have now been incorporated into regulation.

Marketing Subcommittee – Paul Finch

- Launched TC 9.9 LinkedIn site while in Houston to raise awareness on the TC.
- Approximately 133 people currently follow the LinkedIn site.
- Compared the figure with 239 people on the roster.
- We need content to put on the LinkedIn account to draw followers.
- Trying to get the 90.4 presentation on the account.

Japan Data Center Council – Jason Matteson

- Over the last two weeks been corresponding with them.
- Design guide document trying to reference latest Power Trends chart from latest update.
- They were using that without context and they were thinking it was the new Thermal Guidelines.
- We were able to get them the correct references.

GPC-1.6 Terry Rodgers

- Project committee that is developing guidelines for commissioning data centers.
- 2nd meeting held this week.
- Need End Users to participate.
- Will address existing, expansions and new construction.
- Monthly conference calls and then divide into subgroups.
- Sister document to follow standard 202.
- Contact Terry Rodgers to get involved.

Industry Engagements

- Department of Energy/Lawrence Berkeley National Laboratory Center for Energy Efficiency in Data Centers – Steve Greenberg
 - <https://datacenters.lbl.gov>
 - Funded by DOE.
 - Small Data Centers
 - Small data centers are where the energy efficiencies can be gained.
 - Half of the servers reside in small data centers.

- Develop prescriptive packages for utilities to use to incentivize.
 - Webinars sponsored by DOE.
- Data Center optimization initiative
 - Fed govt. initiative to get people to consolidate their data centers and is operated by the OMB with cooperation with GSA.
- Data Center Energy Practitioner Program
 - IT Specialist module will be available soon.
 - Outreach to India and China
- Working on a liquid cooling specification.
- Working on a measurement verification guide along with case studies.

Data Center Energy

Practitioner (DCEP) Training

The DCEP training program certifies energy practitioners qualified to evaluate the energy status and efficiency opportunities in data centers. A list of DCEP Program Developers, Instructors, and Practitioners is also maintained and available here.

Training

List of upcoming and on-demand training events and news via our Twitter feed. Content is focused on information and opportunities to facilitate energy efficiency projects in data centers with special attention paid to resources for federal agencies.

Small Data Centers

Energy efficiency efforts and attention for data centers have historically focused on larger data centers. Despite their comparatively small size, small data centers (defined as server closets, rooms, and localized data centers under 5,000 square feet of computer floor) have significant energy savings potential.

China

Unprecedented demand and policies are driving rampant growth in data centers throughout China. Asia is experiencing 27% data center growth- which is expected to last through 2020. This is over two times the growth rate of other regions, and is dominated by China (Data Center Dynamics, Shanghai 2017). DOE and LBNL are working with China's Ministry of Industry and Information Technology (MIIT) and industry to promote open standards, test procedures, specifications, and evaluation metrics for U.S. and Chinese data centers.

High Performance Computing

Demand for High Performance Computing (HPC) is growing in both the public and private sectors. It is also highly energy-intensive. LBNL has organized a HPC Working Group to address the energy-efficiency issues related to these technologies and provides guidance and resources tailored to HPC.

Utility & State Engagement

Utilities and state energy offices are critical partners in disseminating energy efficiency information, opportunities, and incentives for the marketplace.

Data Center Optimization

Initiative (DCOI)

The Data Center Optimization Initiative (DCOI) requires federal agencies to develop and report on data center strategies to consolidate inefficient infrastructure, optimize existing facilities, improve security posture, achieve cost savings, and transition to more efficient infrastructure, such as cloud services and inter-agency shared services.

Tools & Resources

Toolkits and calculators are available to support the implementation of best practices. Tools cover areas such "early stage" data center profiling to establish a baseline and efficiency potential, and more detailed sub-system assessments to identify opportunities.

Accelerating Energy Efficiency

in Indian Data Centers

Initiative

The energy intensity of data centers, the growth of data center infrastructure in India, and the existing power deficit in the country calls for increased energy efficiency in Indian data centers. A public-private partnership is working to increase the energy efficiency of data centers in India.

Better Buildings Data Center

Partners (Challenge or

Accelerator)

DOE is working with public and private building owners to reduce energy use in data centers. There are over 34 partners committed to date through the Better Buildings Challenge and Data Center Accelerator programs.

Related FEMP Activities

A number of activities supported by the Federal Energy Management Program (FEMP) assist in making data centers more energy efficient. These activities and accompanying resources include the purchase of energy- and water- efficient products, project financing, and institutional change for sustainability.

Development of a Liquid

Cooled Rack Specification

There are currently no common specifications with most liquid cooling solutions being unique and proprietary. Such lack of standards and lack of multi-source solutions are seen as impediments to wide market adoption of liquid cooling. The scope of this project is to develop an open specification for the secondary fluid (closed loop between the CDU and the IT equipment), manifolds, tubing, quick connectors, and the operating conditions.

- Fuel Cell Workshop at NREL – David Moss
 - Fuel Cells and data centers
 - March 20th in Seattle

Publications

- Datacom Book #3: Design Considerations for Datacom Equipment Centers – Larry Ollice
 - Been working on book for two years.
 - Chapter 14 is the last chapter to be finished.
 - Mark Fisher is leading the group working on chapter 14.
 - Need drawings to be integrated and updated from other books.
 - Aiming to be ready end of February and voted on by TC 9.9 voting members by end of March.
- Datacom Book #14: DCIM – Dustin Demetriou
 - Book is complete.
 - Voted and approved by TC 9.9 in December.
 - Sent to Don Beaty for final formatting.
 - Has a new title: Advancing DCIM with IT Equipment Integration
 - Cover shown for new book.
 - 137 pages with six chapters
 - Discussion of the subject matter for each chapter.

IT Subcommittee

- Introduction – Roger Schmidt
 - Liquid cooling white paper was voted out of TC 9.9.
 - Hope to get it out in the next couple of months.
- Liquid Cooling Whitepaper – Mark Steinke
 - Focused only on water systems.
 - Create guidelines and recommendations so we have a common language.
 - Moving from niche to more commodity based systems.
 - Pressure ratings of fittings have been addressed.
 - Discusses failure modes.
 - Final edits to do and then over to publishing. Hoping for a March release.
 - Water quality is addressed.
 - Construction materials are addressed.
 - Filtration and pressure testing is addressed.
 - Working with the IEC to set reasonable pressure test values.
 - It will appear on the TC 9.9 website when it is published.
- HDD Whitepaper – Matt Shumway (not present) covered by Roger Schmidt
 - Matt is finalizing the whitepaper.
 - Concerns the vibrations caused by the cooling fans in the server and the performance/impact on hard drives.
- Cold Shipping Requirements – Joe Prisco (not present) covered by Roger

Schmidt.

- Concerns the requirements for treatment of IT equipment that goes from extreme cold to indoor environments and precautions that need to be taken.
- Joe was working on engaging other manufacturers to get information on the subject.
- Maybe a good candidate for a RTAR?
- Liquid Cooling in Co-Lo's – Dave Moss
 - Met this morning with IT vendors and discussed reasons for hesitancy/fear around liquid cooling.
 - Long term that want to discuss all the reasons for the fear of liquid cooling in the data center.
 - 6-8 weeks to put together a teaser table of contents and then start to work on the larger effort.
 - This is a separate effort from the liquid cooling whitepaper.
 - Weight of the liquid was brought up as a barrier to implementation in existing data centers.
 -
- IEC/ASHRAE – Roger Schmidt
 - Concerns power connections at the back of the server and temperatures.
 - The workgroup that makes the standards for power connectors did not understand our definition of inlet temperature at the server.
 - We define the inlet/ambient temperature at the front of the server.
 - By the time the air gets to the back of the server the air could be 60C+.
 - IEC looks at the local ambient at the connector. Typical rated at 35-40C.
 - Workgroup asked a lot of questions of the IT equipment designers and gained a lot of knowledge.
 - Meeting in October in Brussels of the IEC.
 - The connectors need to be designed for worse case.
 - IEC has not decide on how to handle.
 - Possible that they may require special connectors instead of the standard connectors used today.
 - Not optimistic that IEC will accept derating.
 - AC and DC connectors included in scope.
 - This only concerns power but should be expanded to include networking.

Executive Session – Jason Matteson

- Not Held