



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 26, 2022

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

DATE OF MEETING June 26, 2022 LOCATION Hybrid: Toronto, ON Canada & Virtual

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

VOTING MEMBERS PRESENT	VOTING MEMBERS ABSENT
Gerardo Alfonso	Lex Coors
John H Bean, Jr	David L Moss
Donald L Beaty	Terry L Rodgers
Ecton English	Vali Sorell
John Groenewold	
John M Gross, III	
David F Kelley	
Matt Koukl	
Dave Meadows	
Joe Prisco	
Roger R Schmidt	

CORRESPONDING MEMBERS PRESENT	PROVISIONAL MEMBERS PRESENT
Adenilson Belizário	David McGlocklin
Mukul Anand	Ashwin Siddarth
Henry Amistadi	Mustafa Kadhim Kadhim
Rick Pavlak	Edward Gutowski
Shlomo Novotny	Norman Bourassa
Christopher Muller	CIBI CHAKRAVARTHY N
Thomas Davidson	
Paul Finch	
Gwenn Ivester	
Dustin Demetriou	
Oumou Sidibe	

Hugh Hudson	
Benedict Dolcich	
Jonell Watson	
Mark Seymour	
Steve Greenberg	
David Tootle	
Brad Cochran	
Rajendera Kapoor	
Alexandre Kontoyanis	
Calvin Tang	
Eric Yang	
Matt Archibald	
Mark Steinke	
Mark Monroe	
Bob McFarlane	

GUESTS PRESENT	
Rui Tan	
LekHeng NGOH	
Le Van Duc	
Marcus Hassem	
Thomas Loxley	

PUBLISHED AGENDA

Sunday, June 26, 2022
TC 9.9 Programs, Handbook and Research
5:00 PM – 7:00 PM EST
Location: Hilton, Osgoode (3-Hilton)

Microsoft Teams Meeting
[Link](#)

Attendance
<https://forms.gle/Tc5FUyAGcPzPmjzL9>

Topic		Time	Presenter	In-Person or Virtual
Introduction	Welcome and Introductions	10	John Groenewold	IP
Programs	2022 Summer Toronto & 2023 Atlanta	15	Nick Gangemi	?
Handbook	Chapter 20	10	Bob McFarlane	IP
Research	Study of the Corrosion Impact on Information Technology Equipment in Data Centers Located in Coastal Regions with High Sea Salt Concentrations	15	Mark Seymour	IP
	Wetted Materials Research	10	Mark Steinke	IP
	Open Discussion on Research Topics	15	All	IP
	Total Time:	75	Minutes	

CALL TO ORDER: 06/26/22 5:03 pm EDT - John Groenewold

INTRODUCTION – John Groenewold

- Welcome to the second “Hybrid” meeting
 - Attendees are both in person and joining virtually
- 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)
- ASHRAE Code of Ethics read out
- Overview of today’s meeting
- Room introductions

PROGRAMS - Nick Gangemi

- Reviewed ASHRAE 2022 Annual Toronto
 - Seminar 13: Recent Advances in Data Center CFD Simulations
 - Sunday, June 26 1:30 pm+ – 3:00 pm

- Several folks from TC9.9 attended
 - Good questions
 - CFD guidance book available in bookstore
- Reviewed ASHRAE 2022 Winter Conference Atlanta, GA
 - Tracks presented
 - Not a specific TC9.9 focused track
 - Track 5
 - Maybe have someone consider semiconductor and/or Data Centers having large supply chain impact
 - Track 7
 - Possible to include DC CFD analysis
 - Track 8
 - Maybe TC9.9 should start contributing to this track from a Data Center operators' perspective
 - Maybe describe the different types traditional, MDC, co lo...
 - Sustainability advisor certification – moving to DCs to carbon free
 - Lack of data an issue. More work to be done
 - New group working on decarbonization and liaison to report tomorrow
 - Important dates for Atlanta
 - Tuesday April 5, 2022 – Conference Paper Abstracts, Technical Papers, and Paper Session Requests Due
 - Tuesday April 26, 2022 – Conference Paper Abstract Accept/Reject Notifications
 - Monday July 25, 2022 – Conference Papers Due – Submitted for Review
 - Tuesday August 9, 2022 – Debate, Panel, Seminar Form, Workshop Proposals Due
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 - Friday September 23, 2022 – Conference Paper Accept / Reject Notifications
 - Monday October 10, 2022 – Debate, Panel, Seminar, Forum Workshop Accept / Reject Notifications
 - Ganging TC9.9 seminars together may lead to success
 - TC members are encouraged to work through Nick when working on ASHRAE presentation activities to help with acceptance success rate.
 - Contact Nick Gangemi for interest
 - Nick.Gangemi@vanir.com
 - (585) 721-8795

HANDBOOK – Bob McFarlane

- Now available in online and print
- HVAC Applications Handbook - Chapter 20
 - TC9.9 is responsible for this chapter
- Draft revisions April 1, 2022, COMPLETED ON TIME
- 33 Authors & Reviewers volunteered
 - All draft and edits completed on time
 - Don Beaty did final edit review
 - TC9.9 Board Reviewed & made 3 edits
 - Final Draft & “Chapter Approval Checklist” submitted 06/22/22
 - Contributors displayed
 - Bob M. to email revisors & viewers to get listed in primary writers
 - Must reply asap to be included
- “Index topics” presented
- “Internet search items” presented
- Review plan presented. ASHRAE handbook was impressed with the coordinated effort
- What did we change
 - “Air Distribution” Presently Divided Into:

- Underfloor Air Delivery
 - Overhead Air Delivery
 - Changed To:
 - Underfloor Air Delivery
 - Non-Raised Floor Air Delivery to Incorporate:
 - Overhead Air Systems
 - In-Row Cooling
 - Side Wall Air Delivery
 - Expanded “Data Center Economizer” Section
 - Excellent New Illustrations by Mark Fisher
 - Discovered Economizers Not Really Covered in Any Handbooks!!
 - Added “Data Center Commissioning”
 - Updated “Thermal Envelope” to 5th Edition Numbers
 - Discovered Omission in 5th Edition – Now Corrected by Addendum
 - Massive Re-Wording & Syntax Improvements
 - Moved All “Datacom Book Series” Descriptions to “References”
- Congratulations to all!

RESEARCH – Mark Seymour

- 1675-RP update postponed – Mark Seymour
 - Recognized Charlie Lin and his contributions to ASHRAE
- *Study of the Corrosion Impact on Information Technology Equipment in Data Centers Located in Coastal Regions with High Sea Salt Concentrations* – Mark Seymour
 - Not much progress made since last update
 - Still no real guidance on this topic
 - Split into 2 projects
 - Filtration
 - Sea salt corrosion
 - Focus now on sea salt corrosion aspect
 - Literature search
 - Test equipment design improvements
 - Establish data for the need
 - Open call for TC9.9 members to help support with data
 - Hyperscale customer helped with coupons and data collection
 - Added a dry cloth for salinity measurements
 - Data shown for Temp & RH
 - Data shown for contaminate type relative to humidity levels
 - Ready for the next RTAR cycle for Sept 15th RAC
- 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
 - Raise awareness of the importance of working fluid and wetted material compatibility
 - No real standard or method to validate working fluid and wetted materials compatibility
 - Growing list of working fluids and wetted materials

- Approach
 - Focus on developing a method to determine compatibility
 - Begin with established list of wetted materials for use with treated water
 - Establish the method to expand the list of both working fluids and wetted materials over time
 - Enables a non-proprietary method and list of working fluids and wetted materials
- Status
 - Small group of interested parties forming. First meeting in approximately a month.
 - Begin working on RTAR work statement
 - Begin working on RTAR application
 - Goal is to have first RTAR draft by 2023 Winter meeting
 - Contact if interested in participating
 - Mark Steinke (Mark.Steinke@amd.com)
 - Mark Seymour
- External Airflow Modelling
 - Mark Seymour & Brad Cochran
 - What is external environment
 - Almost infinitely variable
 - Range of wind speed
 - All directions
 - Highly transient
 - Dispersion modeling and transient is key
 - Video showing complicated flow. Highly interactive with the environment
 - Not capturing worst case
 - Building interactions
 - Typical CFD averages turbulence impact
 - Corrosion simulations more impacted by this vs thermal system
 - Need guidance to the industry
 - Free cooling being highly adopted
 - Need to research the CFD analysis of this issue
 - Quality of the results
 - Refine boundary conditions feeding into the model
 - Define sensitivity
 - Gamal question on. Should we define the mission requirement first
 - Needs discussions.
 - Showed example of an improperly applied wind CFD analysis as the problem statement
 - RTAR outcome
 - Independent evaluation of the problem, boundary conditions, worst case
 - Guidelines is primary form
 - Why TC9.9
 - Thermal effects are time averaged
 - Unique challenge presented to the Data Center environment. So, constrained temperature input is driver
 - Adding cooling on fixed roof real estate and stacking cooling on top of cooling. Focusing heat load and demand
 - Methodology was stated as the primary outcome
 - Parallel to 1675. Should be model, wind tunnel, experimental

CALL TO CLOSE: 06/26/22 7:11 pm EDT - John Groenewold

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David F Kelley	
Matt Koukl	
Dave Meadows	
Joe Prisco	
Roger R Schmidt	

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Mukul Anand	David McGlocklin
Dustin Demetriou	Dustin Bremner
Benjamin Petschke	Norm Bourassa
Mark Pavol	Melissa Olson
Steve Greenberg	Eric Tunks
Timothy Shedd	Mustafa Kadhim
Benedict Dolcich	Carlos Lisboa
Nigel Gore	Edward Gutowski
Greg Towsley	Ashwin Siddarth
Jonell Watson	Rani Doughty
Michael Hathorne	Michael Strouboulis
Marianna Vallejo	Calvin Tang
Mark Fisher	Cibi Chakravarthy N
David Quirk	Ali Heydari
Ali Kazmi	
Mark Malkin	
Dave Meadows	
Christopher Muller	

Sang Lee	
Hugh Hudson	
Mark Seymour	
Paul Bemis	
shlomo Novotny	
Robert McFarlane	
David Tootle	
Matt Archibald	
Oumou Sidibe	
Henry Amistadi	
Paul Finch	
Mark Steinke	
Paul Artman	
Jeff Trower	
Girish Anant Kini	
Art Giesler	
Kyle Hasenkox	
Larry Ollice	
Jim VanGilder	
Long Phan	
Brad Cochran	
Eric Yang	
Rick Pavlak	
Mark Monroe	

GUESTS PRESENT	
Abriel Julao	
Paul Kozlov	
Jerry Yeh	
Lance Brown	
Yang Zou	
Kris Crosby	
Matt Gaedtke	
Liz Balke	
Zahra Sardoueinassab	
William Truong	
Galen Gerig	
Shahab Yeylaghi	
Mike Koupriyanov	
Cong Hiep Hoang	
Hillary Weitze	

PUBLISHED AGENDA

Monday, June 27, 2022
 TC 9.9 Main Meeting
 2:30 PM – 7:15 PM EST
 Location: Hilton, Toronto I (C)

Webex Meeting

[Link](#)

Attendance

<https://forms.gle/Tc5FUyAGcPzPmjzL9>

Topic		Time	Presenter(s)	In-Person or Virtual
	Welcome and Introductions	5		
Introduction	What is TC 9.9 Presentation	15	John Groenewold	IP
	TC 9.9 Officers and Membership	10		
Program	2022 Summer Toronto & 2023 Atlanta	5	Nick Gangemi	V
Webmaster		5	Ecton English	V
Research	Tropical Data Centers	30	Tan Rui	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	Gwenn Ivester	V
	MTG.CYB	10	Ecton English	V
	Task Force for Building Decarbonization	10	Lixia Wu	V
Break		15		
International	International Update	10	Don Beaty	?
Industry Engagement	LBNL / DOE	10	Steve Greenberg	?
	Advanced Cooling Facilities	10	John Gross	IP
	OCP Liquid Cooling Workgroup	10	Nigel Gore	V
Publications	Datacom Book 1 – Thermal Guidelines for Data Processing Environments	5	Roger Schmidt	V
	Datacom Book 3 - Design Considerations for Datacom Equipment Centers	10	Dustin Demetriou	IP
	Datacom Book 4 – Liquid Cooling Guidelines for Datacom Equipment Centers (3 rd Edition)	10	Dustin Demetriou / Mark Steinke	IP
	Liquid Cooling Emerging Trends Tech Bulletin	5	David Moss	V
IT Subcommittee	Hot Aisle Considerations for Human Health	5	John Gross	IP
	IEC Power Connector Conclusions	10	Roger Schmidt	V
	Sea Salt Corrosion Update	10	Roger Schmidt	V
AOB	New Group under Section 9 - TG9.Space	5	John Groenewold	IP

CALL TO ORDER: 06/27/22 2:42 pm PST - John Groenewold

INTRODUCTION – John Groenewold

- Welcome
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 - Virtual attendees to stay muted. Unmute to ask a question
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- 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)
- ASHRAE Code of Ethics presented
- Overview of today's meeting
- Introduction to the TC 9.9 website
 - <https://tc0909.ashraetcs.org>
- TC9.9 Introduction, Overview, & Strategy - Don Beaty
 - Presented a brief history and overview of the founding of TC9.9
 - Showed bipolar to CMOS
 - Thermal management consortium trend chart
 - Original scope too narrow
 - Boarded scope to include end to end coverage for facilities to electronic components
 - Massive publication surge with 7 books
 - Thermal guidelines become default standard
 - TC9.9 2009 to present
 - Trend charts presented. Shows progression of “what is a server”?
 - Changed again to applications
 - kW/rack from 2018 work presented
 - rack airflow chart present and showing trends to 2,000 cfm
 - High power CPUs & GPUs
 - Air & liquid cooling chart from last White Paper on emergence of liquid cooling
 - Need to focus back on time to market. Back to trend charts
 - Vender neutral & system agnostic
- TC9.9 Books presented
- TC9.9 Work Activities
 - Handbook Chapter 20
 - Datacom book 1
 - Datacom book 3
 - ADD some more...
- TC9.9 LinkedIn site
 - Growing. Over 1,000 followers
 - Need to generate content to strengthen
- TC9.9 Officers
 - TC 9.9 Chair - John Groenewold, Vantage Data Centers
 - TC 9.9 Vice-Chair - Matt Koukl, Affiliated Engineers
 - TC 9.9 Secretary - Mark Steinke, Advanced Micro Devices
 - Research Subcommittee Chair - Mark Seymour, Future Facilities
 - ITE Subcommittee Chair - Dr. Roger Schmidt, IBM Fellow Emeritus & Syracuse University
 - Standards Subcommittee Chair - Rick Pavlak, Heapy Engineering Retired
 - Program Subcommittee Chair - Nick Gangemi, Northern Air Systems
 - Handbook Subcommittee Chair - Robert McFarlane, Shen Milsom & Wilke, LLC
 - Webmaster - Ecton English, Department of Defense

- Marketing Subcommittee Chair - Paul Finch, KAO Data
- TC 9.9 Liaisons
 - Standard 90.1: Rick Pavlak
 - Standard 90.4: Dave Kelley
 - Standard 127: John Bean
 - AHRI 1360: David McGlocklin
 - Standard 300, Guideline 1.6: Terry Rodgers
 - International: Don Beaty
 - MTG.CYB: Ecton English
 - Building Decarbonization: Lixia Wu
 - Standard 300, Guidleine 1.6: Terry Rodgers
- Voting Members
 - Gerardo Alfonso, Ingeal
 - John Bean, Green Revolution Cooling
 - Don Beaty, DLB
 - Lex Coors, Interxion Headquarters
 - Ecton English, DoD
 - John Groenewold, Vantage Data Centers
 - John Gross, J.M. Gross Engineering
 - Dave Kelley, Vertiv
 - Matt Koukl, Affiliated Engineers
 - Dave Meadows, Stulz Air Technology Systems
 - Dave Moss, Dell
 - Joe Prisco, IBM
 - Terry Rodgers, JLL
 - Roger Schmidt, Syracuse University
 - Vali Sorell, Microsoft
- Voting Members Roll Off
 - Gerardo Alfonso, Ingeal
 - John Bean, Green Revolution Cooling
 - Don Beaty, DLB
 - Lex Coors, Interxion Headquarters
 - Ecton English, DoD
 - Dave Meadows, Stulz Air Technology Systems
 - Terry Rodgers, JLL
 - Roger Schmidt, Syracuse University
 - Vali Sorell, Microsoft
- Voting Members Roll On
 - Paul Finch, KAO Data
 - Jason Matteson, Iceotope
 - Bob McFarlane, Shen Milson & Wilke, LLC
 - Mark Monroe, Microsoft
 - Rick Pavlak, Retired
 - David Quirk, DLB Associates
 - Mark Seymour, Future Facilities
 - Mark Steinke, Advanced Micro Devices
- Reviewed membership data
 - Provisional 90
 - Corresponding 338
- Reminder to keep ASHRAE account email up to date and through job changes
 - Email bounce backs are used to purge the roster

PROGRAMS - Nick Gangemi

- Reviewed ASHRAE 2022 Annual Toronto

- Seminar 13: Recent Advances in Data Center CFD Simulations
 - Sunday, June 26 1:30 PM –
 - Several folks from TC9.9 attended
 - Good questions
 - CFD guidance book available in bookstore
- Reviewed ASHRAE 2022 Winter Conference Atlanta, GA
 - Tracks presented
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 - Nick.Gangemi@vanir.com
 - (585) 721-8795

WEBMASTER – Ecton English (John Groenewold presented)

- 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

LIAISON REPORTS

- Standard 90.1 – Rick Pavlak
 - Energy Standard for Buildings Except Low-Rise Residential Buildings
 - Reviewed scope
 - Compute added and expanded application of the standard
 - TC9.9 and SSPC 90.1 interface review
 - Direct information exchange between TC & SSPC
- Standard 90.4 – Rick Pavlak
 - Energy Standard for Data Centers
 - Definition is ITE space with 10 kW or more
 - Must not be prescriptive, have to stick to the performance metrics as the guide
 - G & H addendum have been submitted in review
 - Both should be out ~July timeframe (07/08/22) for review
 - Minimum efficiency standard is represented
 - Combination of Data Centers and Telco into Datacom and trying to converge and received push back and hence was removed
 - Adoption rate
 - 5 states adopted 90.1 (2019)
 - Washington State has adopted method but use their own metrics
 - IECC updates out of cycle of these standard

- SPC-127 – John Bean
 - Method of Testing for Rating Air Conditioning Units Serving Data Center (DC) and Other Information Technology Equipment (ITE) Spaces
 - Balance roster achieved
 - Reviewing 44 comments previously made
 - Addressing a large portion of these
 - Next meeting this Wednesday (hybrid)
 - Achieve balance on Friday meeting
- AHRI 1360 – Dave McGlocklin
 - Performance Rating Standard for Datacom Air-Conditioning Units
 - Voting members added
 - Dave Kelly is chair
 - AHRI Standards review finished
 - DATACOM STC will review public comments
 - Goal to publish in 2022
- SSPC 300, Guideline 1.6 – Gwenn Ivester
 - Data Center Commissioning
 - Guideline to be used in conjunction with Guideline 0
 - New guideline focused on new construction
 - TC9.9 & GL1.6P members presented
 - 3 sections approved by WG
 - 5 sections in final review
 - 13 sections remain
 - Moving to sharepoint
 - GL1.6P Subcommittee Meetings
 - 5:00 pm Eastern, 4th Tuesday of the month
 - Chair: Wade Conlan, Hanson Professional Services
 - wconlan@hanson-inc.com
 - Gwenn Ivester, JLL
 - gwenn.ivester@am.jll.com
- MTG.CYB – Ecton English
 - Cyber security
 - Focused on getting awareness.
 - Call for participants
- Task Force for Building Decarbonization
 - skipped

BREAK

INDUSTRIAL ENGAGEMENT

- OCP Advanced Cooling Facilities (ACF) – John Gross
 - Two white papers published
 - Data Center Liquid Distribution Guidance & Reference Designs (under DCF)
 - Guidelines for connection of Liquid Cooling ITE to Data Center Facility Systems (under ACF)
 - Current efforts
 - Colocation assessment checklist
 - Survey ACS manufacturing to database key physical and mechanical parameters
 - Starting workstream on hydronic balancing
 - Further evaluation of quick disconnect options and guidance
- OCP Advanced Cooling Solutions (ACS) Workgroup – Nigel Gore
 - Advance Cooling Solution WG
 - Reviewed Open Compute Project (OCP) history
 - Reviewed membership options
 - New structure of OCP presented
 - Monthly meeting schedule reviewed
 - Project wiki for use as reference materials
 - TC9.9 subjects of interest for sub-projects

- ACS Immersion
- ACS Cold Plate
- ACS Door heat Exchanger
- Question: Are other hyperscalers joining
 - Expanding. AWS, Microsoft, NVIDIA
 - Expanding with CO-LO providers as well
- Question: How is info disseminated
 - WIKI, white paper, Summit is the showcase

PUBLICATIONS

- Datacom Book 1 – Thermal Guidelines for Data Processing Environments, 5th Edition – Roger Schmidt
 - Released in April 2021
 - Added research from recent efforts
 - gaseous contaminations
 - RH levels
 - Corrected class B & C for telco
 - Back in via an addendum
 - Need to review and possibly add the sea salt RTAR and outcomes
- Datacom Book 3 - Design Considerations for Datacom Equipment Centers, 3rd Edition – Dustin Demetriou
 - Last edition was published in 2008
 - Substantial re-write of entire book in 2019
 - Several review and comments not addressed
 - Some sections not aligned with recent updates
 - Status
 - Significant edits of many chapters
 - Provide consistent chapter format
 - Tech updates to where Dustin has expertise
 - Outline presented
 - Highlighted chapters need updating
 - Call for volunteers to answer questions
 - Please review displayed asks in the presentation and send email to Dustin to help
 - He will send the question for response or statement accuracy
 - Add recent CFD analysis
 - Timeline
 - Review remaining chapters, add comments, adjust what is needed
 - Draft by winter meeting
 - Question: External CFD included
 - Likely no. future updates
 - External Process is different from internal process is not equal. Maybe just a warning
 - Latest is local and not on basecamp. Will update on piecewise need
 - Don suggests maybe we move back to working meeting sessions
- Datacom Book 4 – Liquid Cooling Guidelines for Datacom Equipment Centers, 3rd Edition - Dustin Demetriou, John Bean, David Moss, Mark Steinke
 - Published 2012
 - Seven pubs on Liquid Cooling
 - Effort to update the book based upon new work
 - Subgroups
 - Group 1 – Tech trends
 - Group 2 – Facility
 - Group 3 – Tech in cooling systems
 - Need help with Immersion cooling fire protection
 - Call for expertise
 - Question: Waste heat reuse should be included
 - Yes. needs discussion
- Liquid Cooling Emerging Trends Tech Bulletin – David Moss (Mark Steinke presenting)
 - Available for review/vote- Fall 2022
 - Follow on to the short 2021 white paper “Emergence and Expansion of Liquid Cooling in Mainstream Data Centers”
 - Motivation:
 - Explosion of compute needs
 - World's appetite for performance is driving the need for liquid cooling
 - Immediacy of this information suggests Tech Bulletin before book inclusion (reformat as

- new chapter in the Liquid Cooling Book)
- Topics covered:
 - Expand the explanation of cooling challenges at the chip
 - Cooling limitations of liquid cooling
 - Similarity and differences between various liquid cooling technologies

ITE SUBCOMMITTEE

- Hot Aisle Considerations for Human Health – John Gross
 - Pushback for temperature elevation
 - Data centers not meant for people but must be a safe working environment
 - Not addressing options for this concern
 - Presented limits on psyc chart.
 - OSHO limits and required breaktimes
 - Call for participation to prepare
 - Mark Monroe – Microsoft interested as they use free cooled GET notes
 - WGBT guidelines
 - Combine effort with some university in
 - Spatial and temporal domain
 - Consider a Tech bulletin for publication
- IEC Power Connector Conclusions
 - Just reviewed the conclusion of the study
 - Added testing temperatures adjusted by manufacturers to now better reflect actual conditions
- Sea Salt Corrosion Update – Roger Schmidt
 - Timeline
 - Give data on marine environment. Next month or so
 - Make updates to RTAR by end of August
 - Push into two TC2.3 & TC2.4 for review
 - Meet December deadline to submit to RAC

RESEARCH

- TROPICAL DATA CENTERS – Rui Tan
 - Singapore is in tropical climate and limits free cooling
 - Try to raise temperature and RH limits
 - Objective: define allowable operating envelopes with different energy efficiency levels for a tropical climate
 - Components
 - Singapore standard
 - Pilot projects
- Singapore Standard update
 - Objective
 - Reduce cooling energy consumption
 - Scope
 - Definitions, guidelines, best practices
 - Optimized
 - Collaboration across academia and industry
 - Draft outline presented
- Technical approach
 - Use TCD & TCO to analyze performance
 - Presented to TC9.9 members in March 2022
- Rationale
 - Following ASHRAE thermal guidelines
 - SS to define
 - What data to collect and how?
 - TCO analysis under tropical condition
 - DC operator to drive TCO analysis
- Focus Areas
 - CapEx
 - OpEx
- Control Parameters

- Main parameters
 - Inlet temperature
 - RH
- Consider cooling costs, ITE electricity cost, ITE replacement cost
- Message
 - Safe to increase TDC inlet temperatures under some conditions
- Reviewed testbed and research
- Project Timeline presented
 - Testbed almost complete
 - Begin experiments and then run to optimal conditions
- Acknowledgements of TC9.9 support and other researchers
- Comment from Mark Monroe. Good work. Encourage this is statistical based and a range. Have you considered time domain?
 - Current assumed constant temp
- Comment Mark Seymour – Have you seen any performance impacts with increase in temp
 - Not an impact on HDD performance based upon literature
 - SSD no data
 - General comments.
 - Fan algorithms can end up overcooling some components due to stepwise functions
- Q: Eric Gant (AWS). What was duration for 37 C
 - A: short period of time ~1 or 2 weeks

AOB

- TG9.Space – Brad Cochran
 - New Group under Section 9 –
 - Maybe add a TC9.9 liaison

Thermal Guidelines. Translations for the Spanish in process

CALL TO CLOSE: 06/27/22 7:00 pm EDT - John Groenewold