

ASHRAE

TC/TG/TRG NO: TC 9.9 Date: Jan. 30, 2017 Location: Las Vegas, NV USA
General Meeting/ Subcommittee and Liaison Report

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

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| VOTING MEMBERS | Employer | Appoint. Year | End Year | Position | Status Code |
|----------------------------|-------------------------------|----------------------|-----------------|-----------------|--------------------|
| Andrew R Baxter | Page Southerland | 2014 | 2018 | Member | Present |
| Thomas A Davidson | DLB Associates | 2014 | 2018 | Member | Present |
| Dr. Dustin Demetriou | IBM | 2015 | 2019 | Member | Present |
| Paul R. Finch | Digital Realty Trust | 2014 | 2018 | Member | Present |
| Jon Fitch | Dell | 2015 | 2019 | Member | Present |
| Jack V. Glass | Citigroup – (Retired) | 2014 | 2018 | Member | Not Present |
| John C Groenewold | JPMorgan Chase | 2014 | 2018 | Member | Present |
| David F Kelley | Liebert Corp | 2014 | | Member | Present |
| Dr. Mukesh K Khattar, PhD. | EPRI | 2015 | 2019 | Member | Not Present |
| Jason Matteson | Lenovo | 2014 | 2017 | Vice Chair | Present |
| Richard Pavlak | Heapy Engineering | 2014 | 2018 | Member | Present |
| Jeffrey P Rutt | Department of Defense | 2014 | 2018 | Member | Present |
| Robin A Steinbrecher | Intel (retired) | 2015 | 2017 | Chair | Present |
| Edward Ka Cheung Tsui | Intelligent Technologies, Ltd | 2014 | | Member | Present |
| Christopher Muller | Purafil | 2016 | 2020 | Member | Present |

| Committee Positions | |
|----------------------------|-------------------------------------------|
| Name | Position |
| Robin Steinbrecher | Chair |
| Jason Matteson | Vice-Chair |
| John Groenewold | Secretary |
| Roger Schmidt | IT Subcommittee Chair |
| Don Beaty | Publications & International Liason |
| Nick Gangemi | Programs Subcommittee Chair |
| Robert McFarlane | Handbook Subcommittee Chair |
| Richard Pavlak | Standards Subcommittee Chair |
| David Quirk | Research Subcommittee Chair & 90.4 Liason |
| Ecton English | Webmaster |

Sunday, January 29th (note attendance lists only apply for Monday's meeting)

5:00 p.m.

The following items were covered:

- 1) General Items – Robin Steinbrecher gave a quick introduction and distributed the sign-in sheet.
- 2) Handbook – Bob McFarlane
 - Chapter 19 in the Applications handbook was completely rewritten. The ASHRAE leadership is happy with the results. There was quite a bit of material that had to be pared down though as the number of pages is limited.
 - There is an opportunity to do electronic updates between the four year cycle major updates.
 - Proposed changes were sent out to voting members of TC9.9 and were to be voted on over the coming two weeks. Assuming they are ratified, they won't be published until April.
 - These are the key changes:
 - a) Added information on useful datacom resources - AHRI Standard 1360
 - b) Significant changes to humidity in the 4th edition of the Thermal Guidelines (book 1 changes) were incorporated – lower humidity levels based on ASHRAE research results.
 - c) Datacom Equipment Components – how to achieve reliability targets with minimal energy impact.
 - d) Power and Thermal Mgmt. - More on humidity, RH and Dew Point. Added a reference to the existing table in the Thermal book.
 - e) Proposed CFD section that adds new metric to better integrate CFD into evaluations.
 - f) Added information on refrigerant side economizers
 - g) Provided a new reference to 90.4 Energy Efficiency standard and its use.
 - h) A bibliography was added along with SPC 90.4 references.
- 3) Programs – Nick Gangemi
 - Nick distributed a handout with information about the future meetings as well as information on the types of sessions that are presented at these conferences.
 - Key aspects regarding programs:
 - 90% acceptance rate on conference and technical papers
 - 50% acceptance rate for seminars
 - Research and case studies are very highly accepted.
 - Chicago deadlines are now posted on ASHRAE website.
 - For the future it may be beneficial to find someone interested in coordinating panel discussions such as on SPC 90.1 v 90.4 as they apply to data centers.
 - To find information on any upcoming meeting go to: ASHRAE.org/[name of the city]
 - Feb.6 is the deadline for seminar Long Beach. Long Beach, CA is the next summer conference location.
- 4) Research – David Quirk
 - David noted that the 2015 ASHRAE Strategic Plan was carried over to 2016.
 - 1755-TRP – Impact of High Humidity and Gaseous Contamination on the Reliable Operation of Information Technology Equipment in Data Centers
 - The research was started in July/2016 at Syracuse University with a literature review which was turned over to the PMS for comments. Syracuse is working on the design and fabrication of components for the test chambers. The study will focus on silver and copper conductors. Testing will employ a 3d printed plastic manifold that blows different chemicals across the coupons. Five gases will be

used and they plan to start testing at the end of February. They will use varied temperature and humidity for a baseline and will investigate rate of change of humidity eventually. If the research bears it out there may be some updates to the Thermal Guidelines regarding humidity and contamination.

- A question was asked about the potential impact on the manufacturing process. There may be changes to material selection due to susceptibility to corrosion but this is unknown until the research is complete.
- Another question arose regarding ROHS compliance and whether this is contributing to corrosion. The answer is yes, but there is no going back and all manufacturers must work with ROHS requirements.
- 1675-TRP – Guidance for CFD Modeling of Data Centers Co-sponsored supporting TC 4.10) (Mark Seymour reported)
 - Florida International University is performing the work. FIU wanted to use a different lab from proposal but it has design issues and the lab is still not ready. There has been some progress but it is frustratingly slow. An older CRAH unit with centrifugal fans is going to be used and server emulators/heat load banks are being ordered. The expectation is that they will have started research by the Long Beach meeting.
- 1739-WS – DC Energy Modeling (Henry Amistadi reported)
 - Henry Amistadi held a meeting earlier in the day with subcommittee members to discuss the process going forward in developing the tools required for Data Center energy modeling. The research paper is essentially dead but the effort moves on and is now focused on guidelines for data center energy modeling computer software. The team has compiled an online reference library and gave access to all the members. There have been twelve presenters to date and their info is on the google drive. The team is focused on what makes a data center different from commercial buildings and is moving away from developing algorithms towards design methodologies and guidelines.
 - The team is trying to support those who want to be 90.4 Compliant in the future. In so doing they have tried to develop simplified energy spreadsheet calculation method and want to develop a series of design guidelines that relate to the data center energy calculations. The goal would be to have an EnergyPlus data center model ready in a year. It would give guidelines on (1) Inlet air at ITE, (2) Server Delta T, (3) Airflow Ratios (bypass and recirculation), (4) IT loads (100% and 50%)
 - It has yet to be determined whether the work could be put before RAC again. As the team progresses they will have to assess that.

Monday, January 30th

Opening and Introductions

- A call for approval of the prior meeting minutes by voting members was made by the chair. The minutes were approved by a unanimous voice vote.
- All present were allowed to introduce themselves at the meeting.

Website – Ecton English, Robin Steinbrecher

- Ecton and Robin reviewed information on the website. The new site which has been in use for more than a year now was based on Ecton's original site design and is now used for all TC's. The link is: <http://tc0909.ashraetcs.org/index.php>
- On the site, under the "Membership" tab there is a button "Join TC 9.9" to request TC 9.9 provisional corresponding membership. Membership is free to a technical committee and does not require ASHRAE membership.
- The website still has an active link to the datacom books in the ASHRAE bookstore on the main page. Members are encouraged to update their contact information through the ASHRAE website as the TC owner has no control over individuals' registrations and correct email addresses. If you need to contact the chair you can find the email link on the site's main page. That address is TC0909@ashrae.net and is always updated to link to the active chair. Suggestions for any changes can be sent to this email.
- All members of TC 9.9 can access the detailed committee member list from their main ASHRAE account on the ashrae.org site.
- Always go to the TC 9.9 site for latest information on upcoming meetings. Selected committee presentations and an overview of TC 9.9 are available on the website and provide basic information on TC9.9 and its latest activities.

Programs – Nick Gangemi

- Nick is the chair for programs and can be contacted at n.gangemi@northernairtech.com
- Nick reviewed the guidelines for submission of seminars, forums, technical papers and conference papers.
- Long Beach, CA is the next conference and all dates had passed for paper submissions.
- See <http://www.ashrae.org/Chicago> for deadline dates for submissions for the next conference.
- Nick provided two handouts - General information about programs and upcoming conferences along with information about TC 9.9 seminars and programs.
- Nick noted that the deadlines were coming faster. Before it was a couple of weeks after the prior conference before the conference papers were due. Now they are due before the prior conference. (Always see the ASHRAE site for the latest dates.

Liaison Reports

- 90.1 update – Richard Pavlak.
 - The 2016 version is available in the bookstore and has over 100 addenda.
 - Rick put together a spreadsheet for each addendum and a short description/comment on applicability to data centers.

- Chapter 6 covers most of the applicable information on data centers.
- Economizers in climate zones other than 0 and 1 are now required.
- The most important thing that did not happen was the approval of 90.4 jurisdiction over data centers. There is no coordination between the two standards.
- Computer rooms are still covered by 90.1 if over 20W/ft² and includes large data centers.
- 90.4 update – David Quirk
 - The standard has been published but has not been adopted by the ICC. It was rejected by letter ballot and Dave believed the ICC vote was due to a lack of knowledge. An SSPC is being formed for continuous update.
 - Now that 90.1 and 90.4 both cover data centers it is up to ASHRAE to resolve the conflict. ASHRAE is committed to a continuous maintenance of the standard.
- SPC127 – John Bean
 - SPC127 covers the method of test for rating CRAH & CRAC
 - The current version was published in 2012 and there is a revision in progress which changes the purpose and scope such as new types of equipment. The tenth draft of the revised standard was issued and there were few comments.
 - On Feb 1 the new revision will be up for a vote via letter ballot for sending out for public comment.
- AHRI 1360 update - David Kelley
 - AHRI 1360 was created three years ago. The committee updated the standard in 2016 by adding horizontal floor mount row based units.
 - The goal is to coordinate the changes with SPC-127. AHRI 1360 will remove all the method of test that will reside in 127. 90.1-2016 references that standard.
 - New efficiency numbers were issued and they are now in the process of adding ceiling mount air conditioners.
 - Slides were put together on the subject that address questions about the regulatory issues associated with CRAC-type units. The website containing the slides is AHRINET.ORG. To find the information on that website follow this path: Resources - Regulatory support - commercial products - Computer room air conditioners

International – Don Beaty

- Don provided some TC 9.9 committee history. Steve Comstock has been helpful in getting TC 9.9's publications out quickly. He is now handling international efforts for ASHRAE and data centers are key to international appeal.
- EU Commission is looking to align with a thermal envelope and it may be in conflict with ASHRAE goals. TC 9.9 has been getting involved using the resources of Paul Finch (member) and other TC 9.9 participants.

Research – David Quirk

- See the summary from the Sunday night meeting. Dave gave a quick summary of the same topics.

LBNL DC Activities – Steve Greenberg

- Steve gave a slideshow on LBNL activities.

- <http://datacenters.lbl.gov> is sponsored by the US government and contains a lot of good information.

The Green Grid (TGG) Performance Indicator – Mark Seymour

- Mark gave a slide show on the new TGG performance indicator which provides operational measures on cooling effectiveness but also addresses risk. The indicator approach tries to balance risks and waste. A whitepaper is now available to everyone not just TGG members (68 pages) at www.thegreengrid.org/en/resources/library-and-tools
- Attached to this is a tool created to visual the indicator which creates a triangle spider chart.

New Publications

- Publication Update – Don Beaty
 - Don Beaty asked the group about any suggestions for new marketing ideas for the Datacom series of books. The full set of Datacom series books is available and can be personalized for bulk purchases. Only ten books (any books) need to be purchased to get a substantial discount. (Contact ASHRAE directly for the discount. The same discounts apply to the digital version.
 - Having sales tables at other conferences was suggested as a channel to sell books. Noted difficulties with accepting payments has been an issue at the conferences. It was suggested that with the frequency of updates to the Datacom series that a subscription may be a good sales option. As a result of the discussion Don asked for volunteers to help him with marketing and he got the names of at least four volunteers who he would contact to assist.
- Datacom Book 13: IT Equipment Design Impact on Data Center Solutions – Dave Moss & Robin Steinbecher
 - Dave Moss gave a short presentation on book 13. It contains four chapters including the introduction and has consolidated a lot of information from various whitepapers.
 - Important information includes airflow demand and delta T increase over time with new generations of ITE.
- Data Center Power Equipment Thermal Guidelines and Best Practices Whitepaper – Jon Fitch and Joe Prisco
 - Jon and Joe gave a presentation on the whitepaper. Jon led the team that developed the paper and it had contributions from a great many people. Go to the TC 9.9 website to download a copy which can be found on the documents page.

ITE Subcommittee Report – Roger Schmidt

- DCIM Whitepaper – Chris Lindberg
 - Chris presented a slide show which described some of the key topics related to DCIM including value vs. difficulty in implementation. He also provided a timeline and progress report. He has representation from a number of companies representing DCIM, facility equipment and ITE suppliers.
- Power Trends Book Update – Susan Smith

- This 3rd edition is roughly 90% complete. Susan previewed some examples of the new data included in the book which now address workload types and types of ITE hardware. The team writing the book will target having a seminar in Long Beach in anticipation of publishing the book later this year.
- Air Perforation for Servers (IEC TC108) – Roger Schmidt
 - An IEC and UL specification change was made that aligned openings on IT equipment with that on consumer electronics. This makes the openings on servers and other IT much smaller and could substantially reduce capability of increase power consumption of ITE. The IT subcommittee provided data to the IEC committee showing the impact. The new requirements would require ITE shipping in 2019 to comply. The IEC committee understands the issue and is working to revert back to previous standard as no safety issue has ever been identified with the previous standard.
- EU Commission – Paul Finch
 - Initiative underway to formalize energy efficiency in servers and data storage products. This would include under maximum power, idle power and different workloads. Paul attended meetings in Brussels to represent and introduce ASHRAE to the Commission and why it would be beneficial to align with ASHRAE thermal guidelines. Draft regulation in circulation would now incorporate the ASHRAE thermal guidelines.
 - The Thermal Guidelines are not a standard but best practice in the US and in equipment delivered around the world due to common product lines from ITE manufacturers. There is some concern that the Commission will be using just parts of the Guidelines and not the full document. Paul will continue to monitor the documents and situation and engage TC 9.9 members as needed.

ASHRAE TC 9.9 Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

| Programs, Handbook and Research Subcommittee Meeting Attendees | | | |
|----------------------------------------------------------------|----|------------|--------------------------------------------|
| First Name | MI | Last Name | Affiliation |
| Gerardo | | Alfonso | Member, Corr. Member or Prov. Corr. Member |
| Terral | L | Altom | Member, Corr. Member or Prov. Corr. Member |
| Andrew | R | Baxter | Member, Corr. Member or Prov. Corr. Member |
| John | H | Bean | Member, Corr. Member or Prov. Corr. Member |
| Donald | L | Beaty | Member, Corr. Member or Prov. Corr. Member |
| Matthew | F | Brown | Member, Corr. Member or Prov. Corr. Member |
| Nicholas | A | Casale | Member, Corr. Member or Prov. Corr. Member |
| Thomas | A | Davidson | Member, Corr. Member or Prov. Corr. Member |
| Dustin | | Demetriou | Member, Corr. Member or Prov. Corr. Member |
| John | | Dumler | Member, Corr. Member or Prov. Corr. Member |
| Michael | J | Ellsworth | Member, Corr. Member or Prov. Corr. Member |
| Ecton | | English | Member, Corr. Member or Prov. Corr. Member |
| Paul | R | Finch | Member, Corr. Member or Prov. Corr. Member |
| Jon | | Fitch | Member, Corr. Member or Prov. Corr. Member |
| Joseph | D | Gangemi | Member, Corr. Member or Prov. Corr. Member |
| David | | Grant | Member, Corr. Member or Prov. Corr. Member |
| Steve | | Greenberg | Member, Corr. Member or Prov. Corr. Member |
| John | C | Groenewold | Member, Corr. Member or Prov. Corr. Member |
| John | M | Gross | Member, Corr. Member or Prov. Corr. Member |

ASHRAE TC 9.9

Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

| | | | |
|-------------|---|-----------|--------------------------------------------|
| Kyle | W | Hasenkox | Member, Corr. Member or Prov. Corr. Member |
| Hugh | | Hudson | Member, Corr. Member or Prov. Corr. Member |
| David | F | Kelley | Member, Corr. Member or Prov. Corr. Member |
| Matt | | Koukl | Member, Corr. Member or Prov. Corr. Member |
| Jason | | Matteson | Member, Corr. Member or Prov. Corr. Member |
| Robert | E | McFarlane | Member, Corr. Member or Prov. Corr. Member |
| David | L | Moss | Member, Corr. Member or Prov. Corr. Member |
| Stephen | A | Mowrer | Member, Corr. Member or Prov. Corr. Member |
| Christopher | O | Muller | Member, Corr. Member or Prov. Corr. Member |
| Shlomo | | Novotny | Member, Corr. Member or Prov. Corr. Member |
| John | P | O'Brien | Member, Corr. Member or Prov. Corr. Member |
| Michael | M | Ohadi | Member, Corr. Member or Prov. Corr. Member |
| Richard | L | Pavlak | Member, Corr. Member or Prov. Corr. Member |
| Long | | Phan | Member, Corr. Member or Prov. Corr. Member |
| David | V | Quirk | Member, Corr. Member or Prov. Corr. Member |
| Terry | L | Rodgers | Member, Corr. Member or Prov. Corr. Member |
| Joel | | Rutledge | Member, Corr. Member or Prov. Corr. Member |
| Jeffrey | P | Rutt | Member, Corr. Member or Prov. Corr. Member |
| Roger | R | Schmidt | Member, Corr. Member or Prov. Corr. Member |
| Mark | J | Seymour | Member, Corr. Member or Prov. Corr. Member |
| Timothy | A | Shedd | Member, Corr. Member or Prov. Corr. Member |

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|----------|---|--------------|--------------------------------------------|
| Saurabh | K | Shrivastava | Member, Corr. Member or Prov. Corr. Member |
| Douglas | | Sick | Member, Corr. Member or Prov. Corr. Member |
| Susan | F | Smith | Member, Corr. Member or Prov. Corr. Member |
| Vali | | Sorell | Member, Corr. Member or Prov. Corr. Member |
| Robin | A | Steinbrecher | Member, Corr. Member or Prov. Corr. Member |
| Jacob | | Svenkeson | Member, Corr. Member or Prov. Corr. Member |
| Russell | C | Tipton | Member, Corr. Member or Prov. Corr. Member |
| David | C | Tootle | Member, Corr. Member or Prov. Corr. Member |
| Herb | | Villa | Member, Corr. Member or Prov. Corr. Member |
| Stefan | | Bangerth | Guest |
| Marc | | Sorge | Guest |
| Jerrold | K | Buterbaugh | Guest |
| Matthew | R | Archibald | Guest |
| Harold | | Simmons | Guest |
| David | | Ritter | Guest |
| Benjamin | | Dolcich | Guest |
| Sophia | | Flucker | Guest |
| Sam | | Allen | Guest |
| Lawrence | | Ollice | Guest |
| John | | Gross | Guest |
| Casey | | Winkel | Guest |

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| | | | |
|---------|--|-----------|-------|
| Steve | | Madara | Guest |
| Holly | | Brink | Guest |
| Hitoshi | | Sakamoto | Guest |
| Mukul | | Anand | Guest |
| Farid | | Parsaej | Guest |
| Tolov | | Tavakkoli | Guest |
| Tianyi | | Gao | Guest |

| Main TC 9.9 Meeting | | | |
|----------------------------|----|-----------|--------------------------------------------|
| First Name | MI | Last Name | Affiliation |
| Gerardo | | Alfonso | Member, Corr. Member or Prov. Corr. Member |
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| Michael | J | Ellsworth | Member, Corr. Member or Prov. Corr. Member |
| Ecton | | English | Member, Corr. Member or Prov. Corr. Member |

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Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment

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| Paul | R | Finch | Member, Corr. Member or Prov. Corr. Member |
| Jon | | Fitch | Member, Corr. Member or Prov. Corr. Member |
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| Ted | F | Jaguszyn | Member, Corr. Member or Prov. Corr. Member |
| David | F | Kelley | Member, Corr. Member or Prov. Corr. Member |
| Matt | | Koukl | Member, Corr. Member or Prov. Corr. Member |
| Christopher | W | Kurkjian | Member, Corr. Member or Prov. Corr. Member |
| Geoff | | Lawler | Member, Corr. Member or Prov. Corr. Member |
| Stuart | | Lawrence | Member, Corr. Member or Prov. Corr. Member |
| Sang | | Lee | Member, Corr. Member or Prov. Corr. Member |
| Mike | | Licitra | Member, Corr. Member or Prov. Corr. Member |
| Ted | | Marwitz | Member, Corr. Member or Prov. Corr. Member |
| Jason | | Matteson | Member, Corr. Member or Prov. Corr. Member |
| Robert | E | McFarlane | Member, Corr. Member or Prov. Corr. Member |
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| Shlomo | | Novotny | Member, Corr. Member or Prov. Corr. Member |
| John | P | O'Brien | Member, Corr. Member or Prov. Corr. Member |
| Michael | M | Ohadi | Member, Corr. Member or Prov. Corr. Member |
| Christian | T | Pastrana | Member, Corr. Member or Prov. Corr. Member |
| Richard | L | Pavlak | Member, Corr. Member or Prov. Corr. Member |
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| Timothy | A | Shedd | Member, Corr. Member or Prov. Corr. Member |
| Saurabh | K | Shrivastava | Member, Corr. Member or Prov. Corr. Member |
| Douglas | | Sick | Member, Corr. Member or Prov. Corr. Member |
| Susan | F | Smith | Member, Corr. Member or Prov. Corr. Member |
| Vali | | Sorell | Member, Corr. Member or Prov. Corr. Member |
| Jeffrey | R | Stein | Member, Corr. Member or Prov. Corr. Member |

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| Edward | K | Tsui | Member, Corr. Member or Prov. Corr. Member |
| James | W | VanGilder | Member, Corr. Member or Prov. Corr. Member |
| Herb | | Villa | Member, Corr. Member or Prov. Corr. Member |
| Marc | | Sorge | Guest |
| Jerrod | K | Buterbaugh | Guest |
| Matthew | R | Archibald | Guest |
| David | | Ritter | Guest |
| Benjamin | | Dolcich | Guest |
| Sophia | | Flucker | Guest |
| Sam | | Allen | Guest |
| Lawrence | | Ollice | Guest |
| John | | Gross | Guest |
| Casey | | Winkel | Guest |
| Steve | | Madara | Guest |
| Holly | | Brink | Guest |
| Lance | | Brown | Guest |
| Hitoshi | | Sakamoto | Guest |
| Annie | | Smith | Guest |

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| | | | |
|------------|--|------------|-------|
| Junta | | Matsuo | Guest |
| Enya | | Schumacher | Guest |
| Julian | | Iosifescu | Guest |
| Katyn | | Sun | Guest |
| Sherman | | Ikemoto | Guest |
| David | | Sickinger | Guest |
| Olu | | Soluade | Guest |
| Peter | | Czerwinski | Guest |
| Joel | | Furman | Guest |
| Brad | | Cochran | Guest |
| Aaron | | Duda | Guest |
| Bill | | Gembinski | Guest |
| Steven | | Hyde | Guest |
| Mukul | | Anand | Guest |
| Scott | | Graf | Guest |
| Andy | | Jackson | Guest |
| Farid | | Parsaej | Guest |
| Mark | | Malkin | Guest |
| Tolov | | Tavakkoli | Guest |
| Tianyi | | Gao | Guest |
| Cheng-Xian | | Lin | Guest |