ASHRAE Technical Committee 1.4

ASHRAE TC1.4 Control Theory and Application
Draft Meeting Minutes
Denver Annual Meeting
June 25, 2013

These draft minutes have not been approved and are not the official, approved record until approved by this committee.

ASHRAE Technical Committee 1.4

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.
1791 Tullie Circle, N.E./Atlanta, GA 30329
404-636-8400

TC/TG/TRG MINUTES COVER SHEET

(Minutes of all TC/TG/TRG Meetings are to be distributed to all persons listed below within 60 days following the meeting.)

TC/TG/TRG NO.: <u>1.4</u>

TC/TG/TRG TITLE: <u>Control Theory and Applications</u>

DATE OF MEETING: June 25, 2013   LOCATION: Denver, CO

<u>DISTRIBUTION:</u>

ALL MEMBERS OF TC

ALL COMMITTEE LIAISONS

ASHRAE Technical Committee 1.4

TC/TG/TRG Activity Feedback Form

Please provide feedback on your TC/TG/TRG activities and return this form to your Section Head by email or drop off a printed copy in the Section Head's mailbox folder outside the ASHRAE Headquarters Room by Tuesday night 9:00 pm.

PLEASE DO NOT LEAVE NUMERIC CELLS EMPTY. ENTER 0 IN CELLS IF THERE IS NO COUNT.

TC#	1.4	Committee Name:	Control Thoery & Applications		
		Chair:	Kimberly Barker		

Meeting was Held (City)		Denver	(Day)	Tuesday	(Date)	6/25/2013

Membership

	Quorum Established (Yes/No)		
	Number Present	Remote Participants	Total on Committee
Voting Members (excluding Non-Quorum Members)	7	0	10
Non-Quorum Members	0	0	
Corresponding Members	8	0	59
Provisional Members	0	0	10
Visitors/Guests	8	0	
# members/guests who are also YEA members	0	0	0

Handbook Responsibilities		Standards Responsibilities	
Volume and Chapter (i.e. A17 Printing Plants)		Standards Number (i.e. SPC 178, Std 90.1, Gdl 2)	
A47 - Design and Application of Controls		SSPC-135	
F7- Fundamentals of Controls		SGPC-13	
		SPC-195P	
Total Number of Chapters	2	Total Number of Standards	2
# Chapters voted out this meeting	0	# Standards recommended	0
Special Publications (last six months)	0	Title:	

Program Activities (For This Meeting)

Total # of Forums			Total # of Technical Paper Sessions			Total # of Conference Paper Sessions			Total # of Seminars		
Submitted*	Sponsor	Co-sponsor	Submitted*	Sponsor	Co-Sponsor	Submitted*	Sponsor	Co-Sponsor	Submitted*	Sponsor	Co-Sponsor
0		0	0	0	0	0	0	0	0	1	0

Current Research Activities (active)		FAQ Responsibilities	
# of active RTARs	2	Total # of FAQ's	3
# of active Workstatements	0	# FAQs updated this meeting	0
# of active TRPs	0	FAQ IDs	
# of active RPs	3		
Total # of Active Projects	2	**TC Website**	
Problems getting RTAR/WS approved?	No	TC has a website (yes/no)	yes
		Website Up-to-date? (Yes/No)	yes
TC Management		Website is on the ASHRAE Server (Yes or No)	yes
	(Yes/No)	Link to website from www.ashrae.org/standards-research-technology/technical-committees is functional? (yes/No)	
Minutes completed on Time?	yes		
Agenda distributed on time?	yes		yes
Members asked to Reconfirm participation (winter)?	yes	**Award Nominations (last six months)**	
Roster Workbooks Completed (Winter)	yes	Distinguished Service Award	0
Did Chair and Vchair attend Training?	yes	Exceptional Service Award	0
Did Handbook Chair attend Training?	yes	Other:Hightower, Research,etc (specify below)	0
Did Program Chair attend Training?	yes	Award :	

Any Concerns or requests for the Technical Activities Committee? [Please type in Space Below]

3. Technical Paper: Report on RP1597 "Stochastic Optimal Control of Mixed Mode   Buildings"   Author: Ryan Tanner of the U of Colorado,

1. SPECIAL SESSION 4 Chaired by Frank Shadpour

This form needs to be updated to support Special Sessions.

TC 1.4 Committee Meeting Minutes

TC 1.4 Control Theory and Application
http://tc14.ashraetcs.org/
Tuesday, June 25, 2013 1:00 – 3:30 pm
Sheraton Denver Downtown Hotel
Denver, CO

TC1.4 Control Theory & Application (20/20)	Tuesday 1:00-3:30p	Governor's Square 15 (PC)
TC 1.4 RP 1597 (6/2)	Sunday 10:00-11:00	Aspen (TZ)
TC 1.4 Control Components and Applications	Sunday 3:00-4:45p	Century (TZ)
TC 1.4 Program	Sunday 4:45-5:30p	Century (TZ)
TC 1.4 RP-1455(8/0)	Monday 9:00-10:30a	Director's Row G (PL)
TC 1.4 Research	Monday 2:15-4:15p	Denver (TZ)
TC 1.4 Handbook	Monday 4:15-6:15p	Denver (TZ)
TC 1.4 Executive (8/0)	Tuesday 7:00-8:00a	Director's Row G (PL)
Special Session 4: Workshop: BIM, Commissioning, and COBie: Does Automated Building Energy Modeling Replace Measurement and Verification?	Sunday, 8:00-9:00a	Room: Governor's Square 14
SEMINAR 10: Control Your Costs and Expand Your Possibilities: Integrated Factory-Mounted Controls	Monday, 8:00-9:30a	Room: Plaza Ballroom E

1) **Call to Order**

   Call to order at 1:05 p.m.

2) **Introduce Members, Guests, and Liaisons**

   Introduction of attendees, 7 voting members in attendance, we have a Quorum

3) **Approve agenda**

   Charti Young moved to accept minutes, Larry Fisher seconded, Voted 6-0-0

4) **Present scope of TC 1.4**

   Chad Moore read scope of TC1.4 committee

5) **Approve minutes from previous meeting**

   Charti Young moved to accept minutes, Larry Fisher seconded, Voted 6-0-0, motion passed

6) **Announcements**

   a) Section Meeting announcements

Art Geisler addressed TC. Mr. Geisler needs documentation for RP1633 granting no cost extension until 1/31/2014..

b) Vic Pinar – TAC

10 voting members total, 7 present

Allowed up to 18 voting members

Handbook Chapters 7 Fundamentals has been updated, 47 Applications

TC 1.4 website is current

c) New ASHRAE Meeting

Cold Climate Design

d) New ASHRAE Technical Committee Forms

Available on ASHRAE website

e) TC's have option for electronic meetings

TC1.4 will not utilize e-meetings at this time

f) TAC has template for chapter presentations

Template is available on ASHRAE website

7) **OLD BUSINESS**

A) PROJECT COMMITTEE AND ONGOING RESEARCH REPORTS

i) SSPC 135 (BACnet) – David Robin

Application subcommittee has created application for VAV Boxes

ii) SGPC 13 (Specifying DDC Systems) – Chariti Young
Meets Saturday 8:00AM-Noon, Plaza Court 1 (PC)

Guideline will be republished in 2014.

Addenda a through i have been approved

Addendum g to address performance monitoring

I. Goldschimdt was asked to assist in writing FMC section

iii) ASHRAE Certified Building Controls Profession certification – David Kahn

ASHRAE Certification Committee declined TC1.4's offer to develop the certification materials.

ASHRAE responded to TC1.4 that the ASHRAE membership has expressed a need for Controls Training.

ASHRE E-Learning course on Controls is available.

iv) RP-1455 (Advanced Control Sequences for HVAC Systems) - Michael Pouchak

Met Monday 6/24/13 at 9am.

Updated five tasks.

Reported on % complete

Motion for no cost extension until 1/21/2013. Vote (7-0-0) motion passed.

Reviewed action items

Discussion on where the information from the RP should reside (Handbook, Guideline, etc.)

v)   RP-1597 (Stochastic Control Optimization of Mixed-Mode Buildings) – Kim Barker

No cost extension to 1/21/14 has been granted.

Discussion of remaining tasks (install new Sequence of Operation in actual buildings)

vi) RP-1633 (Data & Interfaces for Adv. Building Maintenance & Operation) – Reinhard Seidl

Met Monday 6/24/13.

No cost extension to 1/21/13 has been granted.

a) SUB-COMMITTEE REPORTS

i)   Executive – Kim Barker

(1) Adjustment of Voting Member Roster

10 current members, 8 members rolling off June 2014.

Taking 4 members off current role, adding 4 new members at the conclusion of this meeting. (this is being done to create balance and continuity)

(2) Discussed recruiting ASHRAE Distinguished Lecturers with TC1.4 related speaking topics.

(3) Created TC1.4 Education Sub-Committee

(a) Larry Fisher to chair the sub-committee

(b) Sub-committee members (Barry Bridges, William Kilna, Marcelo Kosta, Gary Cole, Jin Wen, Chariti Young, Jim Coogan, Dave Kahn, Chad Moore)

(4) Education Sub-Committee topics

(a) Nathan Hart with ASHRAE PDC asked for assistance in developing the following ASHRAE education seminars

(i)   Implementing Energy Management (full day seminar)

(ii) Implementing Energy Management (half day seminar)

(iii) Introduction to BACnet

(b) PDC needs course outlines from TC1.4

(c) PDC pays for course development

(d) Larry Fisher suggested pulling together all ASHRAE information to develop course outlines

ii) Handbook – Dave Kahn

   Applications Handbook Chapter 47 due March 2014.

   Dave Kahn to ask for extension to March 2014 deadline.

   Handbook subcommittee to send out Applications Handbook Chapter 47 for review by the full committee by 12/25/13.

   Full committee discussed ASHRAE unit vents. After the discussion the committee recommended removing the ASHRAE unit vent cycles from the Applications Handbook Chapter 47.

iii) Control Components and Applications – Barry Bridges

   Reviewed minutes from subcommittee meeting.

   Discussed controls training and available resources.

   Discussed need to market controls training

   Two threads on ASHRAE Exchange were created on controls topics.

   Encouraged TC1.4 members to actively engage in the ASHRA Exchange discussions.

   Recommended posting ASHRAE Exchange link on the TC1.4 website.

iv) Reference Applications – Kim Barker

   No Meeting

v) Research – Steve Taylor

   Control Loop Tuning Project Work Statement approved by RAC.

   Motion was introduced to create an RTAR, Title: Advanced Sequences of Operation for HVAC Systems – Phase II Central Plants and Hydronic Systems . Motion by Chariti Young, 2nd by Larry Fisher. Vote (6-0-0) motion passed.

   Motion was introduced to create a new ASHRAE Guideline

      Title: High Performance Sequences of Operation for HVAC systems.

      Purpose: The purpose of this guideline is to provide standardized high performance sequences of operation for heating, ventilating, and air-conditioning (HVAC) systems.

      Scope:

      2.1   This guideline provides detailed sequences of operation for HVAC systems that are intended to:

      - Maximize energy efficiency
      - Meet ASHRAE standards such as Standard 62.1 and Standard 90.1
      - Provide realtime fault detection and diagnostics
      - Provide stable control of space environmental conditions and HVAC systems and equipment

     2.2   Sequences in this guidelines are expressed in both English language format (for engineers and operators to understand their intent) and logic flow diagrams (for unambiguous application by control system programmers).

     2.3   This guideline also provides functional tests that can be used to confirm proper implementation of the sequences in control systems.

Mark Hydeman to chair Guideline Committee

Vote (6-0-0) motion passed.

TC7.9 to co-sponsor Guideline

vi) Program – Frank Shadpour

TC1.4 held two seminars at the Denver meeting. Special Session 4 and Seminar 10

Chuck Coward suggested TC1.4 sponsoring additional seminars on Factory Mounted Controls and COBie.

Discussed Program deadlines (see Program minutes attached)

Discussed how to get more college students involved in ASHRAE

vii) Standards – Steve Taylor

90.1. Drafted addenda to modify economizer hi-limit controls and settings

viii)   Webmaster – Chad Moore

b) Committee Liaison Reports

i)   TC 1.5 (Computer Applications) – Mike Pouchak

ii)   TC 2.1 (Physiology & Human Environment)

iii) TC 2.8 Building Environmental Impacts and Sustainability) Kim Barker

iv) TC 5.2 (Duct Design) – Larry Felker

v)   TC 5.6 (Control of Fire & Smoke) –Larry Felker

vi) TC 6.1 (Hydronic Systems) – Dave Kahn, TC6.1 approached TC1.4 Handbook subommittee for help with modifying the control valve chapters in ASHRAE Handbooks

vii) TC 6.7 (Solar Energy Utilization) – Gaylen Atkinson, TC6.7 is seeking more seminar speakers and presentations at ASHRAE meetings.

viii)   TC 7.1 (Integrated Building Design) – Larry Felker

ix) TC 7.3 (Operations & Maintenance Management) – Jim Gartner

x)   TC 7.5 (Smart Building Systems) –John House, Researching passive occupant comfort control

xi) TC 7.6 (Systems Energy Utilization) – Kim Barker

xii) TC 7.9 (Building Commissioning) – David Bornside, Agreed to co-sponsor Loop Tuning Research Project.

xiii)   TC 9.6 (Healthcare Facilities) – Kim Barker

xiv)TC 9.10 (Laboratory Systems) – Jim Coogan, Lab Design Guide is going to be revised.

xv) T 9.11 (Clean Rooms) – Jim Coogan, Creating New Design Guide

xvi)SSPC 62.1 (Ventilation and Acceptable IAQ) − Len Damiano

xvii)   SSPC 90.1 (Energy Efficient Design of New Buildings) − Darryl DeAngelis

xviii)   SSPC 166 (Terminology) – David Bornside, Underwent major update.

xix)SGPC 0.2 & 1.2 (The Commissioning Process) – David Bornside

xx) SPC134 (Graphic symbols for HVAC systems) – David Bornside, In process of being re-issued.

xxi) US TAG to ISO/TC 205 (Building Environmental Design) – Damian Ljungquist

xxii)   SPC 189.1 Design of High Performance Building – Bogi Setty

xxiii)   MTG.EAS – Energy-Efficient Air Handling Systems for Non-Residential Building: −Len Damiano, Needs more input before moving forward.

c) Society Committees

i)   Professional Development Committee – Larry Fisher

2) New business

a) Electronic & Physical (E&P) TC Meetings

Discussed the technological obstacles to overcome. Jim Coogan voiced his experience, ASHRAE's technology not working yet.

TC decided not to participate in Electronic meetings in the near future.

b) Roster updates:

i)   Voting Members Rolling off after Denver:

Voting members rolling off: Raj Daswani, Damian Ljungquist

Voting members rolling on: Gary Cole, Jeff Stein, Gaylen Atkinson, Chris Kenny

3) Upcoming Deadlines

a) For New York:

March 15, 2013 – Conference Paper abstracts due.
April 19, 2013 – Full Technical Papers due
July 2, 2013 – Conference Papers due (for abstracts that were accepted)

b) For Seattle:

January 9, 2014 – Conference Paper abstracts due.

February 13, 2014 – Seminar, Forum, and Workshop Program Proposals Due
February 25, 2014 – Technical Papers Final Review
June 2, 2014 – All PowerPoints Due Online

4) Next Meeting – New York, NY, January 19-22, 2014

5) Adjourn

Kim Barker moved to adjourn,

Adjourned at 2:50 p.m.

ASHRAE Technical Committee 1.4

Attachment 1 – Attendance

Attachment 1 - Attendance

Name	Position	Company	Components and Applications	Program	Research	Handbook	Executive Breakfast	Main Committee
			Sun		Mon		Tues	
Voting Members								
Steven Linn	Pass chair	Johnson Controls Inc						
Gaylen Atkinson	CM	Atkinson Electronics Inc	X	X				X
Chuck Coward	Member	Waddell Engineering	X					X
Larry Fisher	Member	ECT Building Automation	X	X				X
Raj Daswani	Member	Arup						
Philip Haves	Member	LBNL			X			X
Damian Ljungquist	Member	JDL Business Services						
Nemat Lotfi	Member	Eaton Corporation						
Jin Wen	Member	Drexel University		X	X			X
Chariti Young	Member	Automated Logic Corp	X	X	X	X		X
Non-Voting Officers								
Kim Barker	Chair	Siemens Bldg Technologies Inc	X	X	X	X	X	X
Al Garza	CM	TekSys Dynamics						
Barry Bridges	Chair, Control Comp	Sebesta Blomberg & Associates	X	X	X	X		X
Dave Kahn	Vice-Chair, Handbook Subc		X	X		X	X	X
Frank Shadpour	Chair, Programs	SC Engineers, Inc.	X	X			X	X
Jim Coogan	CM	Siemens Building Technology	X	X			X	X
Steve Taylor	Chair, Research	Taylor Engineering		X	X			X
Corresponding Members								
Angela Lewis	CM							
Anthony Lee	CM	Trane						
Boggarm Setty	CM	Setty & Associates Ltd						
Brett Eubanks	CM	Taylor Engineering			X			
Carol Lomonoco	CM	Johnson Controls Inc						
Chad Moore	vice-Chair	Engineering Resource Group, Inc	X	X	X	X	X	X
Christopher Frank Benson	Prov. CM	University of Utah		X	X			X
Christopher Miller	CM	P2S Engineers Inc.						
Curtis Klaasen	CM	Energy Systems Engineering						
Darryl DeAngelis	CM 90.1 Liason	Belimo Americas						
David Bornside	CM	Siemens Building Technology	X		X			X
David Branson	CM	Inc.						
David Underwood	CM	CERL						
Dennis Stanke	CM	The Trane Company						

Name	Position	Company	Sun Components and Applications	Program	Mon Research	Handbook	Tues Executive Breakfast	Main Committee
PLEASE SIGN AND RETURN TO CHAIR								
Don Bailey	CM	TLC						
Donald Hardin	CM	Enviromatic Systems						
Garry Cole	CM	Belimo Americas	X	X	X	X		X
George Naim	CM	Trane						
Gregor Henze	CM	Univ of Colorado						
Gregory Dobbs	CM	Penn State Univ						
James Gartner	CM	Four Seasons Environmental Inc						
James Nietfeld	Prov. CM	Alabama Controls						
Jarod McMains	Prov. CM	Burns & MCDonnell						
Jeffrey Stein	CM	Taylor Engineering LLC						
Jeremy Tsai	CM	ARUP						
Jim Tello	CM	San Diego Gas & Electric						
John House	CM	Johnson Controls Inc			X			
John Kettler	CM	Kettler Control Consultants						
John Zhou	CM	The Trane Company						
Kevin Kerr	CM	Automated Logic NY/NJ						
Kristopher Kinney	CM	Quantaum Energy Services & Technologies						
Larry Felker	CM	Belimo Americas						
Len Damiano	Member	Ebtron Inc			X			X
Corresponding Members								
Lindell Davidson	CM	Professional Design Quality						
Mashuri Warren	CM	A S I Controls						
Mark Hydeman	CM	Taylor Engineering						
Michael Monahan	Prov. CM	Burns & McDowell						
H Michael Newman	CM	Cornell University						
Michael Pouchak	CM	Honeywell International	X	X	X	X		X
Michael Schell	CM	AirTest Technologies						
Michael Wetter	CM	Lawrence Berkeley Lab						
Mike Gibson	CM	Echelon Corporation						
Nicholas Gayeski	Prov. CM	KGS Buildings						
Ofer Pittel	CM	Pittel Engineering						
P Reid Hart	CM							
Paul Pinkston	CM	Prime Air Products						
Paul Wacker	CM	Honeywell						
Peter Armstrong	CM	Battelle/Pacific Northwest Nat'l Lab			X			

Name	Position	Company	Components and Applications	Program	Research	Handbook	Executive Breakfast	Main Committee
			Sun		Mon		Tues	
Reinhard Seidl	Prov. CM	Taylor Engineering						
Richard Franseen	CM	Honeywell Inc						
Robert Coleman	CM	Trane Company						
Robert Old	CM	Siemens Building Technologies Inc						
Sean Graham	Prov. CM	DLB Associates						
Shui Yuan	CM	United Technologies Research						
Sharon Dinges	CM	The Trane Company						
Steven Bushby	CM	NIST						
Verle Williams	CM	Utility Services Unlimited Inc						X
Dr. Wangda Zuo	Prov. CM	Lawrence Berkeley Lab						
William Pienta	CM	Siemens Building Tech						
Xiaohui (Joe) Zhou	CM	Iowa Energy Center ERS DMACC			X			
Xinlei Wang	CM	University of Illinois						
Zachary Obert	CM	Wisconsin Energy						
Guests								
Ryan Tanner		C.U. Boulder	X	X	X	X		X
Art Giesler	RLI	Permavent			X			X
Vic Penar	TAC Liasion							X
Yaoyu Li		University of Texas						X
Marcelo Acosta		Armstrong	X	X		X		X
Michael Bobker		City University of NYC	X					
Yan Chen		Penn State University	X	X				
Joe Kilcoyne		SC Engineers	X	X				X
David Shadpour		ACCO	X	X				X
Alex Mathers		Qualcomm	X	X				X
Michelle Shadpour		SC Engineers	X	X				X
Steven Shadpour		SC Engineers	X	X				X
Takaharu Saegusa		Azbil Corporation	X					

PLEASE SIGN AND RETURN TO CHAIR

Attachment 2 – Agenda

ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc.

1791 Tullie Circle, NE • Atlanta, Georgia 30329-2305 ☎404-636-8400 • Fax 404-321-5478

Agenda

TC 1.4 Control Theory and Application
http://tc14.ashraetcs.org/
Tuesday, Jun 25, 2013 1:00 – 3:30 pm
Sheraton Denver (formerly the Adams Mark)
Denver, CO

TC1.4 Control Theory & Application (40) (Screen)	Tuesday 1:00-3:30p	Governor's Square 15, (PC)
TC 1.4 RP 1597 PMS (8)	Sunday 10:00-11:00	Aspen, (TZ)
TC 1.4 Control Components and Applications	Sunday 3:00-4:45p	Century, (TZ)
TC 1.4 Program Sunday	Sunday 4:45-5:30p	Century, (TZ)
TC 1.4 RP-1455 PMS (8)	Monday 9:00-10:30a	Director's Row G (PL)
TC 1.4 Research	Monday 2:15-4:15p	Denver (TZ)
TC 1.4 Handbook	Monday 4:15-6:15p	Denver (TZ)
TC 1.4 Executive	Tuesday 7:00-8:00a	Director's Row G (PL)
TC 1.4 RP-1633	Tuesday 9:00-10:00a	Taylor Engineering Suite
SPECIAL SESSION 4 (INTERMEDIATE) Workshop: BIM, Commissioning, and COBie: Does Automated Building Energy Modeling Replace Measurement and Verification?	Sunday, 8:00-9:00 a	Governors Square 14
SEMINAR 10 (INTERMEDIATE) Control Your Costs and Expand Your Possibilities: Integrating Factory-Mounted Controls	Monday, 8:00-9:30a	Plaza Ballroom E

1) **Call to Order**

2) **Introduce Members, Guests, and Liaisons**

3) **Approve agenda**

4) **Present scope of TC 1.4**

5) **Approve minutes from previous meeting**

6) **Announcements**

   a) Section Meeting announcements

   b) Vic Pinar – TAC

7) **OLD BUSINESS**

   A) PROJECT COMMITTEE AND ONGOING RESEARCH REPORTS

      i) SSPC 135 (BACnet) – David Robin

      ii) SGPC 13 (Specifying DDC Systems) – Chariti Young
      Meets Saturday 8:00AM-Noon, Plaza Court 1 (PC)

ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers
Inc.

1791 Tullie Circle, NE • Atlanta, Georgia 30329-2305 ☎404-636-8400 • Fax 404-321-5478

iii) ASHRAE Certified Building Controls Profession certification – David Kahn

iv) RP-1455 (Advanced Control Sequences for HVAC Systems) - Michael Pouchak

v) RP-1597 (Stochastic Control Optimization of Mixed-Mode Buildings) – Kim Barker

vi) RP-1633 (Data & Interfaces for Adv. Building Maintenance & Operation) – Reinhard Seidl

a) SUB-COMMITTEE REPORTS

  i) Executive – Kim Barker

    (1) Adjustment of Voting Member Roster

    (2) Consideration of creating an Education Sub-Committee

      (a) PDS 22

      (b) PDS 36

  ii) Handbook – Dave Kahn

  iii) Control Components and Applications – Barry Bridges

  iv) Research – Steve Taylor

  v) Program – Frank Shadpour

  vi) Standards – Steve Taylor

  vii) Webmaster – Chad Moore

b) Committee Liaison Reports

  i) TC 1.5 (Computer Applications) – Mike Pouchak

  ii) TC 2.1 (Physiology & Human Environment)

  iii) TC 5.2 (Duct Design) – Larry Felker

  iv) TC 5.6 (Control of Fire & Smoke) –Larry Felker

  v) TC 6.1 (Hydronic Systems) – Dave Kahn

  vi) TC 6.7 (Solar Energy Utilization) – Gaylen Atkinson

  vii) TC 7.1 (Integrated Building Design) – Larry Felker

  viii) TC 7.3 (Operations & Maintenance Management) – Jim Gartner

  ix) TC 7.5 (Smart Building Systems) –John House

  x) TC 7.6 (Systems Energy Utilization) – Kim Barker

  xi) TC 7.9 (Building Commissioning) – David Bornside

  xii) TC 9.10 (Laboratory Systems) – Jim Coogan

ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers
Inc.

1791 Tullie Circle, NE • Atlanta, Georgia 30329-2305   ☎404-636-8400 • Fax 404-321-5478

xiii) T 9.11 (Clean Rooms) – Jim Coogan

xiv) SSPC 62.1 (Ventilation and Acceptable IAQ) − Len Damiano

xv) SSPC 90.1 (Energy Efficient Design of New Buildings) − Darryl DeAngelis

xvi) SSPC 166 (Terminology) – David Bornside

xvii)   SGPC 0.2 & 1.2 (The Commissioning Process) – David Bornside

xviii)   SPC134 (Graphic symbols for HVAC systems) – David Bornside

xix) US TAG to ISO/TC 205 (Building Environmental Design) – Damian Ljungquist

xx) SPC 189 Design of High Performance Building – Bogi Setty

xxi) MTG.EAS – Energy-Efficient Air Handling Systems for Non-Residential Building: –Len Damiano..

c) Society Committees

i)   Professional Development Committee – Larry Fisher

2) New business

a) Electronic & Physical (E&P) TC Meetings

b) Roster updates:

i)   Voting Members Rolling off: Damian Ljungquist, Raj A Daswani

ii)   Voting Members Rolling on: Gaylen Atkinson, Kris Kinney, Jeff Stein, GaryCole

3) Upcoming Deadlines

July 8, 2013: Deadline for program proposals (seminars and forums) to be submitted for the 2013 winter meeting in New York, NY. Conference Website: http://www.ashrae.org/newyork/

August 15, 2013: New or revised Work Statements and RTARs are due to MORTS for RAC consideration at the 2013 Fall RAC meeting.

August 30, 2013 TC/TG/TRG meeting minutes from the Denver meeting are posted on TC website and distributed to membership by this date.

September 23, 2013 Full Technical paper drafts and Conference paper abstracts are due for the 2014 Annual Meeting in Seattle, WA. Seminar and forum session proposals are due February 13, 2014. Conference Website: www.ashrae.org/seattle/

4) Next Meeting – New York, NY January 18 – 22, 2014

5) Adjourn

Attachment 3 – SSPC135 Report

Attachment 4 – SGPC13 Meeting Minutes

AGENDA/MINUTES
SGPC13 Guideline for Specifying Building Automation Systems
6/22/2013 / 8:00am – 12 noon
Sheraton Denver Concourse Level Plaza Court 1

Attachment 4 – SGPC13 Meeting Minutes

1. **CALL TO ORDER**

   1.1. Introduction of Members and Guests

   1.2. Quorum Determination (5 Voting Members) – No quorum

   1.3. Select secretary for minutes – Dave/Chariti

   1.4. Announcements - None

2. **AGENDA REVIEW**

3. **MINUTES FROM PREVIOUS MEETINGS**

   3.1. Minutes from 1/26/2013, and from teleconferences on 10/17/12, 11/27/12, and 1/9/13 were approved by letter ballot on 2/22/2103. See Letter Ballot Tally Report attached. Editorial changes suggested by Jeremy Roberts were made to 10/17 minutes.

   3.2. Dave moved, Grant seconded to approve the minutes from teleconferences March 20, April 24, May 22. Yes from Dave, Grant, Chariti, Kim. Chariti will send a continuation letter ballot.

   3.3. Specification typo re: controllers used in outdoor environments. The Attendees of the 3/20 teleconference moved that the full committee approve implementation of Steve's recommendations. Yes from Dave, Kim, Chariti, Grant. Chariti will send a continuation letter ballot.

4. **ROSTER CHANGES**
   Dave Kahn rolls on as Chair after June meeting. Chariti Young, Jim Kelley roll off as voting members after June meeting. Effective after September Tech Weekend, Kris Kinney becomes Vice Chair. Dave Kahn's, Kris Kinney's, and Kim Barker's voting terms extended. Steven McCloskey added to roster as nonvoting member. Ron becomes voting member and webmaster. As regards balance on the committee, Mike Gibson is no longer with Echelon and Jeremy Roberts is leaving Lonmark. Chariti will send revised Chair's Recommendation form to Susan LeBlanc.

5. **PUBLICATION PUBLIC REVIEW DRAFTS –** Note: For any Publication Public Review motions all project committee members must be given the opportunity to vote. If all members are not present a continuation letter ballot will be sent to ballot the absent members. All project committee voting members voting **no with comment** will be offered a right to appeal upon Board approval of publication. All project committee voting members voting **no without comment** will not be offered the right to appeal.

   5.1. Addendum 13g – Performance Monitoring. Final public review form submitted in early June following 2nd public review with no comments.

   5.2. Addendum 13h – CSI changes
   Public review ended 12/24 with no comments. Final Publication form submitted 1/25. Galley proofs approved by Dave Kahn 5/24.

   5.3. Addendum 13i - Benefits of a Building Automation System (BAS) rewrite
   Public review ended 12/24 with no comments. Final Publication form submitted 1/25. Galley proofs approved by Dave Kahn 5/24.

   5.4. Republication of Guideline – Standards approved republication. Grant, Kim, Dave, and Chariti volunteered to help review the galley proof.

AGENDA/MINUTES
SGPC13 Guideline for Specifying Building Automation Systems
6/22/2013 / 8:00am – 12 noon
Sheraton Denver Concourse Level Plaza Court 1

6. **RESPONSES TO COMMENTERS – Ken Gillespie**

   6.1. Ken Gillespie's 17 comments are closed.

7. **CONTINUOUS MAINTENANCE PROPOSALS**

   7.1. Network infrastructure and Integration revision
   Grant reviewed his proposal to provide some guidance language on networking, with pointers to a separate clause addressing networking specific issues.

   Ron reviewed his rework of his networking spec following the May teleconference.

   Rather than trying to do a full integration of networking guidance into the existing spec, we will include pointers to a separate networking clause or clauses that begin at the network terminal of the controller and address networking specific guidance and spec language. Provide options (all IP, 1 IP, mixed IP and non-IP) for spec language related to different networking options. Provide use case examples that might help illustrate the most appropriate option for a given set of business continuity requirements. Include in physical security and reliability guidance verbiage for Integration Requirements.

   Put a Table or list in Section 1 (design considerations) to help BAS Designer determine whether he is responsible for an item such as UPS power and what sections of the Guideline and Spec need to be reviewed.

   Controls Contractor vs. System Integrator? Two different roles.

   Tier designations – used in Data Center world with specific meaning/certifications attached. Need label other than "Tier." Want to use names rather than numbers. Discussion over what the Tiers and their names should represent. 3 tiers represent different skillset requirements and contracting responsibility for network connectivity. Do not have full consensus on names yet. Possibilities: Enterprise IP, Building IP, BAS non-IP; or, Enterprise Level, Building Level, Control Network. Will work on Section 12, then revisit names.

   Possibly use AHU example in spec to illustrate different networking possibilities.

8. **REPORT FROM STANDARDS LIAISON**
   Ensure that information from Chair's breakfast gets disseminated to committee. Ensure that committee is aware of ASHRAE Code of Conduct. For example, Guidelines/Standards are copyrighted and should be used in accordance with the copyright policy. Thanks to committee. Send approved minutes to new liaison and Susan LeBlanc. Highlight any items of interest. Consider revising and submitting a new work plan for January. ASHRAE is considering term limits for voting members. Voting members should be at 50% of the meeting and vote in 60% of letter ballots in a calendar year. If a voting member has less participation the chair, at his/her option, may remove them from the roster as non-responsive.

9. **OLD BUSINESS**

   9.1. Forum results from Dallas were very good.

   9.2. Panel discussion (future program) re: roles and responsibilities for BAS and network integration especially as relates to IT and other groups and accommodating needs to successfully put together a truly integrated system. Case study? Take to TC 1.4. IT (Kris Kinney), Owner, GC, Architect. Not discussed.

   9.3. Grant will write a summary of the Thursday forum for publication in the Journal. Not discussed.

   9.4. Integration of Master Spec with Guideline. Not discussed.

   9.5. Work Plan review. Not discussed.

AGENDA/MINUTES

SGPC13 Guideline for Specifying Building Automation Systems
6/22/2013 / 8:00am – 12 noon
Sheraton Denver Concourse Level Plaza Court 1

9.6. Action items review. Only new work items were discussed.

10. **NEW BUSINESS**

10.1.　　　Dave will talk to Tech Pubs about restrictive ASHRAE copyright policy.

11. **NEXT MEETING:**

Teleconferences: 4th Wednesday of month Aug, Sept, Oct.

8-Noon Saturday Jan 18, 2014 New York, NY

12. **Adjourn**

Adjourned at 12:05.

AGENDA/MINUTES
SGPC13 Guideline for Specifying Building Automation Systems
6/22/2013 / 8:00am – 12 noon
Sheraton Denver Concourse Level Plaza Court 1

SGPC 13 Meeting Attendance List

Present	Name	Affiliation
Voting Members		
X	Chariti Young	Chair, Automated Logic Corporation
X	Dave Kahn	Vice Chair, RMH Group
X	Kim Barker	Siemens
	Mike Gibson	
	James R Kelley	Msktd & Associates
	Kris Kinney	Westin Solutions
	Jeremy J. Roberts	
	David Underwood	US Army Corps of Engineers
X	Grant Wichenko	Appin Associates
Liasons		
	Douglass S Abramson	SPLS Liaison
	Mark Weber	Staff Liaison
Guests		
	Damian Ljungquist	JDL Business Services
	Gideon Shavit	Self
	Kenneth Chappell	ARCOM
	Steven Linn	Johnson Controls
	Joshua New	Oak Ridge National Laboratory
X	Ron Bernstein*	Ron Bernstein Consulting Services (LonMark)
	Steve Tom	Automated Logic Corporation
X	Greg Bradshaw	Bradshaw Building Solutions

*would like to become a voting member

**would like to become a corresponding member

AGENDA/MINUTES
SGPC13 Guideline for Specifying Building Automation Systems
6/22/2013 / 8:00am – 12 noon
Sheraton Denver Concourse Level Plaza Court 1

Action Item Register

Responsible Member (Assistant)	Description	Due Date	Completed
Chariti Young	send continuation letter ballots for motions from this meeting	6/2013	7/2013
Chariti Young	send revised Chair's Recommendation form to Susan LeBlanc	6/2013	6/2013
Chariti Young	Send approved minutes to new liaison and Susan LeBlanc.	6/2013	7/2013
Ron Bernstein	Set up 2 hr teleconferences for 4th Wednesday of month Aug, Sept, Oct.	7/2013	
Chariti Young	Notify standards of teleconferences 4th Wednesday of month Aug, Sept, Oct	7/2013	7/2013
Dave Kahn	review Grant's rewrite	7/2013	
Grant Wichenko	summary of January forum to go in ASHRAE journal	2/2013	
Chariti Young/Dave Kahn (Grant Wichenko, Jeremy Roberts)	Review DDC > BAS changes and galley proofs	6/2013	
Ron Bernstein	draft clause 12 and circulate for review before Aug teleconference	8/2013	
Jeremy Roberts (Chris Larry, Grant Wichenko)	Draft chapter on Integration with other systems, include cost of integration (may have some starting words from Chris Larry)		
Kim Barker (Grant Wichenko)	Guidance related to BAS backup/recovery plan – include in network stuff.	6/2013	
Kim Barker	UPS language for both panels and OWS. Include types of UPS (structure similar to Schneider's paper from Grant).		
Ron Bernstein (Mike Gibson, Grant Wichenko)	Network infrastructure and structure of devices needs an overhaul and update. Infrastructure, devices, management/configuration, tools, UI, enterprise connectivity, system security and reliability. Figure out what to do with gateways (Kris Kinney), addendum related to hardware/software requirements if sharing a facility data network (Mike Gibson) Will teleconference regularly between 1/2013 and 6/2013 to work on this area.		
	Addendum/proposal re: airflow measurement Guidance similar to water metering for supply/return and OA, also include info for performance monitoring		
	Smart sensors and actuators are missing in sections 7, 8, and 9		
	Guideline defines "owner, contractor, subcontractor, and engineer. But then we use the terms installer and supplier throughout the document. In some places it's unclear whether "supplier" means the manufacturer or the controls subcontractor. Use master format names and definitions from section 1.		
	Ensure that all temps are provided in F and C		
Completed since last meeting			
Chariti Young	send list of email addresses for committee members to Ron	1/2013	1/2013
Chariti Young	draft response to Ken Gillespie re: performance monitoring	1/2013	1/2013
Chariti Young	fill out spreadsheet and chair recommendation re: membership for SPLS liaison	1/2013	6/2013
Ron	send gotomeeting invitation and google drive invitation to committee	1/2013	1/2013
Steve Tom	draft revision to address problem with ambient temperature typo.		3/2013

AGENDA/MINUTES

SGPC13 Guideline for Specifying Building Automation Systems

6/22/2013 / 8:00am – 12 noon
Sheraton Denver Concourse Level Plaza Court 1

Letter Ballot Tally Report

DATE: 2/15/2013
MOTION: Dave Kahn moved and Kim Barker seconded that we approve the attached meeting minutes for teleconferences on 10/17/12, 11/27/12, and 1/9/13, as well as our face-to-face meeting in Dallas on 1/26/13
Date of Meeting: N/A **Vote Count:** N/A
Date Continuation Letter Ballot Sent: **2/15/2013**
Date Continuation Letter Ballot Closed: 2/22/2013
FINAL Vote Count: **7-0-0-0-2 (yes-no-no without comment- abstain-not returned)**
X denotes votes cast during meeting
CLB denotes votes cast during continuation ballot

NAME	Interest Category	Yes	No	No without Comment	Abstain	Not Returned	Notes
Chariti Young, Chair	Producer	CLB					
David Kahn, Vice-Chair	General	CLB					
Kimberly Barker	Producer	CLB					
Mike Gibson	Producer					X	
James Kelley	General	CLB					
Kristopher Kinney	User					X	
Jeremy Roberts	Supplier	CLB					
David Underwood	General	CLB					
Grant Wichenko	General	CLB					
TOTALS		**7**	**0**	**0**	**0**	**2**	

Interest Category	Yes	No	No Without Comment	Abstain	Not Returned	TOTAL
General	4					4
Producer	2				1	3
Supplier	1					1
User	0				1	1
TOTAL	7					9
PASSED	X	*FAILED*				

REASONS FOR NEGATIVE VOTE(S):

REASONS FOR ABSTENTION(S):

Attachment 5 – TC 1.4 Executive Subcommittee Minutes

Attachment 6 – Handbook Subcommittee Minutes

MINUTES

TC 1.4 Handbook Subcommittee
6/24/2013 / 4:15 – 6:15
Denver Sheraton Denver room

1. **CALL TO ORDER**

2. **REPORT FROM APPLICATIONS HANDBOOK LIAISON**

   2.1. If a time extension is needed to incorporate new research send the request in to Chris. Include justification, schedule and reason for requesting the delay. Dave K will send request.

3. **OLD BUSINESS**

   3.1. The assignments from the last meeting were reviewed everyone agreed to continue working on their respective assignments these are copied below:

   3.2. The chapter was divided into roughly three page sections and a "Section Captain" volunteered for each section. The Captain will review and edit their section calling upon other TC members. for input as needed. The sections are:
   Page numbers refer to the printed document
   47.1 through 47.3 including electric coils   Chad Moore
   4.3 through 47.6   Marcelo Acosta
   47.7 through 47.11 and Dynamic OA Reset   Gary Cole
   47.11 through 47.15   Barry & Jim Coogan
   47.5 through 47.21   Ryan Tanner and Dave Kahn
   Charity will look at the overall structure and editing
   Dave Kahn will combine edits and fill in as needed.

4. **NEW BUSINESS**

   4.1. The subcommittee will recommend to TC 1.4 that the section covering the ASHRAE unit ventilator cycles be reduced to a brief summary and a reference given to the 2011 version of the handbook for further information.

   4.2. Robert Walker from TC 6.1 will send their current draft of the valve chapter to Dave Kahn. Kim will distribute it to the full TC for comment and suggestion. Return comments to Dave Kahn who will compile them and return to Robert Walker.

   4.3. Dave Kahn will add variable speed and digital compressors to the DX section. The minimum airflow for DX cooling will be mentioned.

   4.4. The new section on heat pump controls was reviewed and commented on. Gary will review the coverage of heat pumps in other handbook chapters so we can reference them. If geofield system controls are not covered, we will address them. It may be useful to include an object list.

   4.5. Dave K will propose words on the stack effect of DP transmitter sense tubing.

   4.6. The section on dynamic reset should be updated to reflect the latest research. Gary will contact Steve Taylor to get a contact to get the research or words to put in the handbook. This is of significant interest to the membership and should be included. The publication references may not be available by the March deadline. Dave K to request an xtension.

   4.7. Dave K will revise the chapter figures as needed. They will be inserted in the chapter for the reviewers. ASHRAE wants them as separate attachments. Dave K to contact Heather Kennedy to find out the format requirements.

   4.8. The purge section in the draft will be deleted.

   4.9. Barry's section was reviewed. Dave K will incorporate it into the master document.

   4.10. Dave K will send Steve Taylor a request to review and comment.

   4.11. Jim Coogan is working on chilled beams and radiant heat/cooling control.

5. **NEXT MEETING AND SCHEDULE**

Note the final TC vote is scheduled for New York. An extension to July is requested.

Jan 21 2014 Annual Meeting New York Applications TC vote to publish

Jan 20, 2014 New York Handbook subcommittee meeting 4:15 to 6:30

Jan 15 2014 Comments received from TC for incorporation into final version

Dec 20 2013 100% Draft sent to TC for their review and comment

November 12, 2013 subcommittee go to meeting to review chapter edits; 12:00 central time

October 22, 2013 Subcommittee go to meeting to review individual sections; 12:00 central time

October 15, 2013 Individual assignments complete and sent to committee for review and compilation

6. **Adjourn**

TC 1.4 Handbook Subcommittee Attendance List

Present	Name	
X	Chariti Young	
X	Dave Kahn	
X	Kim Barker	
X	Chad Moore	
X	Ryan Tanner	
X	Gary Cole	
X	Marcelo Acosta	
X	Barry Bridges	
X	Mike Pouchak	
Liasons		
X	Chris Ahne	Applications Handbook Liaison
X	Bob Walker	Liaison from TC 6.1 Valves

ASHRAE Technical Committee 1.4

Attachment 7 Control Components and Applications Subcommittee Minutes

ASHRAE TC 1.4 Control Theory and Application
Sub-committee: Control Components and Applications
Meeting MINUTES: Sunday 23 June 2013

Meeting: 1500-1645, 27 January 2013; Sub Committee Chair Barry Bridges

SCOPE Includes: Components (Sensors, Actuators, Controllers, OWS), Networks, Control Applications Loops, Building management reporting

Components and Control Application "brainstorming session" lets TC 1.4 members and guests talk openly about issues and hot topics without being subjected to budgets or due dates.

Attendance: An attendance list was circulated and used in the various TC 1.4 subcommittees.

Introductions Around the Room: Those in attendance verbally and written on the attendance form provided Name, Business affiliation.

TOPICS UPDATE
Certified Building Control Professional
There was not a lot of immediate interest in certification, but it was considered too small a demand to provide a profitable product at this time. There needs to be a business case for creating a building control professional certification.

Notes from Dallas Forum
About 30 folks attended the forum and we had a good exchange of comments as we went through a series of topics that explored the many areas of expertise needed for certification. Comments from attendees written on their evaluation forms and voiced in discussion confirmed the need for controls **training** in the HVAC industry. Overall the evaluations indicated it was an "excellent" program.

Comments from others in attendance at the forum:
Interest is not just with HVAC and DDC. IT has a security concern as the Stuxnet virus was presented as an example. BACnet and Tridium are already working on those security issues for individuals and other control devices to be authorized and accepted to the network. Integration is a challenge where an individual needs to know IT, the how-to, use of the communications back bone.

Issues were considered typical with packaged controllers where the supplying contractor qualifications were not spelled out in the spex or submittal. The capabilities of the equipment provider were limited and not able to support the interface with network infrastructure. It was considered that huge gaps existed between the industries involved providing factory mounted controls and the overall building Automation System. It is not sufficient to know just the basic operation of a given vendor's typical control settings, but the means to integrate with the whole.

The Survey and Forum indicated interest in the **training** required to be qualified to consider certification.

There are 5 areas of knowledge expected of a certified control engineer. HVAC Mechanical systems, Network IT, Graphic communications to users, Programming and Electronics.

Training

Getting students involved may be promoted through showing them the use of actual controllers on actual buildings. One individual recalled taking a program where the students are expected to write a sequence of operations in prose form, and then build a board that electrically provided the expected action and then write software for a digital program. The final exam was to prove their product worked correctly. Michael Bobker reported that Engineering students and interns are assigned to use real data from campus buildings and use the www.pnl.gov/buildingretuning software. They use this protocol to confirm building systems performance with trend logs. This activity was part of a college level course. It linked with course work on building systems modeling and provided practical exposure to what is in a system and how it works and impacts the operation energy in building performance. The reality allowed field trips where the flow diagram symbol of a little fan was changed into a big "real" fan. Even when there is a test lab the lab equipment is small compared to what is used in real application.

One important aspect of the reality experience is to have students discover that modeled energy use can't establish a good "real" base line if at the beginning of the comparison the original design/installed system has been compromised by the maintenance crew.

Student chapter involvement and presentations on campus to encourage involvement. When young engineers participate then return to campus they have a much better connection. Another connection could be SWE and YEA to get ASHRAE members to attend with the students and have the professional's present programs.

The challenge is to pull out the best that exists and connect those operations to the instant readings and benchmark values that are associated with power generation and energy use. Building Performance Measurement Protocols (available in ASHRAE bookstore) provides other metrics including IEQ as part of the control performance not just energy.

If energy is the only issue of payback that can be easily monitored the n the economics of first cost choices should be linked to ongoing measurement of real time LCC audits.

Keep Training Simple And Basic

Jim Bouchat noted that with a professional Development Course, PDC you could have a greater interest in certification if the program were to target a basic simple standard of control and application to HVAC. It is not the design engineer that needs certification if you could get a ground swell of knowledgeable users as folks are trained. The Chicago chapter had a one day seminar on building controls for young engineers. The younger guys have both the interest and time to take the classes. We need to consider a simplified version that ties all the aspects discussed together but with a narrower syllabus.

Further an online controls course is not available or exciting to attend, why has it not taken off is that no one markets it. The courses available are more about robots and springs not buildings and HVAC it is all MATLAB. Perhaps to make a more interesting program is to treat the building as a robot.

Material And Presenters - A Lab Practical In College

TC 1.4 already has Distinguished Lecturers Jim Coogan and Frank Shadpour who also has a course and three books. Some concern is that academics do not teach practical engineering and especially not controls. An area to address would be how to get Universities interested in teaching a practical approach to controls. Perhaps as part of the modeling world by tying energy model. From there to tie to other performance standards. The use of TC 1.4 Advanced controls

research RP 1455 may provide a comparison of a given actual control as set against the advanced sequence to prove you actually get the result, per LBL Michael Vetter.

Could it ever be a sanctioned academic curriculum? Since you don't need a PE or a BS to do control what would be the better candidate for that responsibility. On the job it is a multiple curriculum, training structure. The basic design now taught considers if capacity at peak load and physical dimension will fit in the space then is surprised when there are part load and transition concerns that requires a control guy to fix. An alternative for ASHRAE would be to rally with a research project to get traction and support as part of academic research.

Curently courses provided by ASHRAE include a once popular 6 hour basics of BACnet that has ended as an ALI and an Introduction to BACnet a 3 hour has been rebooted as ALI on occasion Control training per PDS 30: Control Documentation Implementation And Integration is a 3 hour instructor led course outline. This could provide the touch and feel of how it would be delivered and a sample of how it would work. There are PDS set as 6 one hour courses for presentation at either chapter meeting or as a ALI at society.

HVAC controls needs a champion and this is the committee to do it, but if not will a company become the default for example the website Webctrl? The big control companies have lots of resources, but are usually late adapters and necessarily promote their own product.

Ashrae Resources For Training
There is not a distinguished lecturer with the expertise to be a control speaker but perhaps we could develop a traveling program to send to ASHRAE Chapters or schools. Larry Fisher outlined experience with support from 4 significant providers to for more than a commodity, but a bundled package in the back of a truck. The idea would be to bring in a starter DDC that could be installed cheaply with basic connectivity and leave it to the school staff to take care of it.

The idea would be to mesh the control theory folks with the manufacturers/vendors of HVAC even if they are not control companies they are marketing companies. The benefit would be a useful demonstration that would lead to a design build team with an AE firm or better directly hired by owner. With the exposure, a tight specification would improve acceptance of good control.

Standardization of control may be possible perhaps on a BIM platform. It could launch with a minimum standard for the basic operation of a typical HVAC system. Guideline 13 extensively revised to be used as an HVAC performance control option. This could also link to TC 1.4 research project 1455: optimum DDC sequence of operation. In this format what does a 1.4 training program look like as an e-learning course?

A key for training would be to get it into the handbook. Training is about delivering a message but you need to know the message to deliver. If tied to modeling, to BIM or to CoBIE. Some think that the professors like CoBie

How To Get New Students Interested in Controls
Physics is all equations, and not our daily experience of the real world. Perhaps a model for better connections would be through applications of control sequences to thermal mass flow systems that are essential to HVAC. One possible path would be to challenge students to provide a control system in steps. First write it out, then build it in an electronic model, and then write the software. Actually, building the physical system and evaluating the real with the model would be the point of the course. The school provides fundamentals and plumbing we need to provide

better definition of how to make change that recognizes thermal lag and writes it in as a reaction delay.

Robert Elsiver had a 13 course control course written in a format for e-learning. TC 1.4 has this and other old courses to revamp or throw away. The hand book is not friendly as a learning experience. One may expect that if it (control training) were a good idea it would have been thought of before. There are courses in the control companies, but a controls company perhaps does not want folks to have that training if not an employee. A lot of knowledge is out there if we build a common resource they will come. Control companies trained their folks on their system, but typically only hired in house to go on to higher programing.

Commissioning And Controls
Take a sequence and it is executed with a commissioners functional test. With different sequences of control there different Cx FPT's There is a benefit to a standard control sequence and the VA as one example is looking for a means to vet controls, what to look for in the sequence and on how to Cx controls and their HVAC applications. Control company field installers are not trained to Cx their own system

With a standard control sequence a standard Commissioning, Cx Functional test can be developed. lots of topics could be possible through a ASHRAE exchange. To that end TC 1.4 will set up in-house chat rooms and threads

Several other topics were considered but not discussed in detail
Existing Control Training available
Existing programs for which TC1.4 is responsible are over 7 years old and need major overhaul.
PDS-13 Design and Specification of DDC Systems
PDS-22 DDC Retrofits: From project planning thru performance verification
Larry Fisher will review the documentation and provide a triage estimate of using them in the future. TC 1.4 will need to make a final decision.

MTG multi-discipline TG – Energy Efficiency of Air Handlers (Dallas meeting Saturday)
Len Damiano and Chuck Coward were interested to be on committee. and will be assigned as our reps to the committee, this links with 5.1 and with other MTG.
MTG – Building performance Metrics Sun. DASH Progress (Dallas meeting Saturday)
In a different MTG the topic DASH Database Analysis of Sustainable and High Performance Buildings: Benchmark energy, IEQ, water, Real estate financial, occupant productivity.

Sensor quality and reliability:

Std 111 TAB includes calibration, continuity, placement, identification sensors.

Humidity, CO2, Air Flow Monitoring stations
Can a damper position be an accurate air flow measuring station, or can pump speed provide an accurate liquid Flow Meter.

Green Building Controls Integration
Gaylen Atkinson Special session 4s at 0800 Sunday BIM, COBIE, Cx: Does modeling replace M&V? Solar collector on DHW and Predictive control from model with actual weather.
Frank Shadpour follow-up with possible seminar. More information on the web for smart building smart alliance also the Army COE is considering BIM CoBIE BAS energy visualization.

LEED buildings are all over the map for actual energy performance but advocacy does not mean final performance. One time Cx is never rechecked. Perhaps there is a shared interest in green control through TC 7.3 or 7.5

Instant readings from many inexpensive imbedded sensors on the walls, clothes, cell phones could provide actual loads as they change instead of delayed surrogates like duct pressure, or space air Temp.

Controls for Commissioning
Cx of many similar devices like VAV TU selects a random sample and simulates extremes, and discontinuities and part load to see response, accuracy and stability. Can BAS automation create a discontinuity for analysis in "normally" healthy controls?

Statistically significance, a 0.3°F space T error on every stat, has little impact on the occupants so while a statistically significant error, has no clinical significance. What criteria of error measurement defines a comfort complaint?

Graphic displays with interactive scratch pads for Cx and operator to indicate useful and missing info that leads to identify calculated points to add onto existing graphics?

Attachment 8 – TC 1.4 Research Subcommittee Minutes

Attachment 8 – TC 1.4 Research Subcommittee Minutes

TC 1.4 Control Theory and Applications
Research Subcommittee (RSC) Activities   **Denver – June 24, 2013**

RSC Meeting Summary:

1. Announcements

   a) 58 active RPs totaling $11 million.
   b) "Innovative Research Grants": intended for out-of-box research, not through TCs (unsolicited). None yet approved out of 36 proposals.
   c) There is still a major shortage of RTARs and WSs at the moment. Only 5 RTARs and 2 WSs reviewed at this meeting. RAC encouraging TCs to produce more.
   d) New procedures for PESs:
      - Each member individually completes scoring sheet
      - PES meets along with liaison to compare scoring. Liaison must be present.
      - Members update scoring sheets and select contractor
      - PES chair send all scoring sheets and selection decision to liaison
      - Award is confidential until formal approval by RAC
   e) An RTAR is not required – may go direct to Work Statements. If we want to do that, first review with RAC liaison to verify that subject will be approved.
   f) There is a new RTAR form that can be downloaded from ASHRAE website after this meeting. New RTARs must use this form. It includes wording limits to keep the RTAR short. Many RTARs have included too much info – more like a WS. Also, prior knowledge of subject (background) must include references not just author opinions.
   g) Reminder:
      - RTARs should be reviewed by liaison prior to submission to RAC. TC 1.4 Research Liaison is Art Giesler RL1@ashrae.net.
      - Proposal Evaluation Criteria & Weighting Factors must be thoroughly edited specific for the project. The example in the template is just that. Note that "student involvement" in the template is not a stipulated priority, just an example.

2. Active Project Status:

Name	Project	PMS	Status
RP 1455	Advanced Control Sequences for HVAC Systems - Phase I Air Dist and Terminal Systems	Pouchak-chair, Underwood, Bridges, Ljungquist	PMS met Monday morning. Sequences are complete and programming into ALC is almost done. Requested a no-cost extension to January 21, 2014.
URP 1597	Stochastic Control Optimization of Mixed-Mode Buildings	Kim Barker-chair; Michael Wetter, Chariti Young, ~~Steve Taylor~~	The URP 1597 PMS met Sunday. TC 1.4 approved no cost extension to January 31, 2014. Testing and verifying control rules in the Research Support Facility (RSF) in Golden, CO, to be completed by August 2013. To date, no significant energy savings. Implementation in NASA building will not be done due to lack of support from NASA. Taylor dropping off PMS due to scheduling conflicts.
URP 1633	Data and Interfaces for Advanced Building Maintenance and Operation	Reinhard Seidl Jim Kelsey, Kristin Heinemeier, Chariti Young, ~~Steve Taylor~~	PMS to meet Monday 5pm. TC 1.4 approved no cost extension to January 31, 2014. Tasks 1 to 3 complete. Tasks 4 (Mock interfaces) started. Task 5 (feedback) to be complete by January. Taylor dropping off PMS due to scheduling conflicts.

3. Pending Research Project Status:

Status	Project	Champion	Remarks
WS 1587 w/TC 7.9 Co-Sponsor	Closed Loop Control – Performance Measurement and Evaluation	Steve Taylor Bill Pienta	TC 1.4 approved WS in March. Conditionally approved with comments by RAC. After fixes are approved, WS will bid this fall.
RTAR 1639	Comparison of Methods to Control and Maintain Building Pressurization	Len Damiano Barry Bridges Steve Taylor	Taylor could not develop WS – scope not clear. Deadline passed at this meeting. RTAR will be left on list but not developed until work scope is clearer.

Status	Project	Champion	Remarks
RTAR TC 4.7 w/1.4 Co-Sponsor	Development of Modelica Models for Evaluation of Supervisory Control Strategies in ASHRAE Handbook	Michael Wetter Phil Haves	Not yet resubmitted
RTAR-1697 cosponsor with TC7.5	Reduce Simultaneous Heating and Cooling in Commercial Buildings	Zheng O'Neill	TC asked to work on WS with TC 7.5
Possible	Optimized Sequences for Chilled and Hot Water Plants	Steve Taylor	Sequel to RP1455. Taylor has developed RTAR for RSC and TC review.
Possible	Optimized Supply Air Temperature Reset Strategies	Jim Coogan Steve Taylor Joe Zhou	No progress. Jim, Steve Taylor, and Joe Zhou to develop RTAR.
Possible	Demand Controlled Ventilation for Parking Garages	Molly McGuire Jeff Stein	No progress. DCV now allowed for exhaust in Standard 62. California Title 24 has just added CO requirement for garages >10000 cfm.
Possible	Effectiveness of Night Setback and Optimum Start	Peter Armstrong Barry Bridges Dave Underwood	Analyze energy impact of different levels of setback vs. shut-off. RTAR needed.
Deleted	~~Impact of Airflow Sensor Fouling~~	~~Chad Moore Chris Benson~~	~~Research to see how particles in air streams affect the long term accuracy of various DP and thermal type sensors. RTAR needed.~~
Possible cosponsor with TC1.5	HVAC System Thermal Control and Energy Performance using Work & Data Exchange Processes	Michael Pouchak	Improved control via data exchange from work related systems to EMCS. TC voted at 1/29/13 meeting to cosponsor. Submitted by TC 1.5 to liaison – returned with comments.
Possible	Field Validation of RP1455 Sequences	Mark Hydeman Steve Taylor	Field testing to show that RP1455 sequences "work". Possibly develop Cx functional performance tests to validate proper implementation.
Possible	Open Generic Language for Control Systems – Phase I Proof of Concept	Michael Wetter Phil Haves Joe Zhou	Open language that can be used not only for DDC applications but also for modeling
Possible	Selecting Control Valves	Steve Taylor	On hold. RP must wait until 1587 is done – need loop "goodness" factor first.
Possible	Reset of space setpoints seasonally or using online daily forecast	Kim Barker Gwelen Paliaga	Determine if comfort and efficiency are improved by using seasonal space temperature setpoint reset or using next-day forecast obtained via internet. Also using forecast for pre-cooling strategies. Could start with simulation followed by real-building studies.
Possible	Object Oriented HVAC Control	Brent Eubanks	Rules connecting system components to use for hierarchal alarms and more.
Possible	Improved reset logic	Steve Taylor	More stable reset logic than trim & respond which always results in oscillations.
Possible	Integrating occiupant comfort preferences with organizational needs and building spatial − temporal thermal performance	Gregor Henze	Comfortable and productive people in effective organizations save money.

4. Research Deadlines:
   a) August 15, 2013 for RTARs and WS to MORTS for consideration at spring meeting
   b) Other regular deadlines: May 15 (for June meeting), December 15 (for January meeting)
5. In Attendance: See main TC attendance table.

RESEARCH TOPIC ACCEPTANCE REQUEST (RTAR) FORM
Sponsoring TC/TG/MTG/SSPC/EHC/REF: <u>TC 1.4 Control Theory & Application</u>
<u>Title</u>: <u>Advanced Sequences of Operation for HVAC Systems – Phase II Central Plants and Hydronic Systems</u>

<u>Applicability to ASHRAE Research Strategic Plan</u>:
This research applies to the following areas of ASHRAE's 2010-2015 strategic plan.

> Goal 1: Maximize the actual operational energy performance of buildings and facilities
> Goal 7: Support development of tools, procedures and methods suitable for designing low-energy buildings.

<u>Research Classification</u>: Basic/Applied Research

<u>TC/TG/MTG/SSPC Vote</u>:	**<u>Reasons for Negative Votes and Abstentions</u>**:
TC 1.4: 8-0-0-2	None

<u>Estimated Cost</u>:	**<u>Estimated Duration</u>**:
$150000	24 months

<u>RTAR Lead Author</u>	**<u>Expected Work Statement Lead Author</u>**
Steve Taylor, staylor@taylor-engineering.com	Steve Taylor, staylor@taylor-engineering.com

<u>Co-sponsoring TC/TG/MTG/SSPCs and votes</u>: None

<u>Possible Co-funding Organizations</u>: None

<u>Application of Results</u>:
The sequences will become an appendix to Guideline 13 *Specifying Direct Digital Control Systems* (or a new guideline being proposed by TC 1.4) and issued as a special electronic publication

<u>State-of-the-Art (Background)</u>:
Modern direct digital control (DDC) systems are fully programmable either using pre-programmed logic created by the manufacturer or with programming created by the installer or user. But while many HVAC subsystems and applications are similar if not identical, there are few industry standards for control sequences. This results in the following problems and inefficiencies:

- Almost every application is treated uniquely often with custom logic that must be prepared and debugged over and over again. The result is a waste of resources and, because of the limited time devoted to system programming and commissioning, systems that are never fully debugged and free of operational problems.

- Poorly written or incomplete control sequences are commonly blamed for poorly operating building systems. Writing precise, concise, and bug-free sequences is very difficult given the complexities of modern HVAC systems and few engineers do it well. Installing contractors are often left to complete or correct poorly written sequences often without a complete understanding of the design intent.

- Control sequences mandated by energy efficiency standards such as ASHRAE 90.1[i] are not always implemented correctly if at all due to lack of familiarity by the programmers who are often not ASHRAE members and often not practicing design engineers.

- Optimum sequences for chilled water plants has not yet been determined in a general form. There are a number of papers[ii,iii] on techniques to optimize control sequences but almost all require some level of computer modeling of the system and system components, and the associated amount of engineering time that most plant designers do not have. PG&E's *CoolTools™ Chilled Water Plant Design and Performance Specification Guide*[iv] include some example sequences, but they are not comprehensive and not always described in sufficient detail for them to be implemented without additional development. Taylor[v]

developed a generalized approach, but the range of equipment performance parameters (e.g. chiller kW/ton, tower GPM/HP) was limited and the sequences apply only to two-chiller plants.

- Optimum sequences for boiler plants varies substantially with boiler type. Staging logic for modulating condensing boilers, which are rapidly gaining market share, is the opposite of conventional boilers (run as many boilers as possible at their minimum unloading point vs. run as few as possible) but this is not well known in the industry so condensing boiler plants are underperforming.

- The commercial control system market is extremely competitive often resulting in insufficient time devoted to system programming and commissioning, in part because the custom nature of the programming for each project is so time intensive. Standardized sequences along with standardized functional test scripts will significantly reduce first costs while simultaneously improving performance.

- DDC systems are very powerful, yet their power is not fully utilized. For instance, few systems are programmed with real-time diagnostic algorithms to detect faults, yet almost all systems have the hardware and software capability to do so. These diagnostics could be used to detect system faults that result in energy waste or failure to maintain process or comfort conditions.

Advancement of the State-of-the-Art

Standard control sequences for common HVAC applications will provide the following benefits:

- Reduce engineering time for design engineers. Rather than develop sequences themselves, they can adapt standard sequences that have been proven to perform.

- Reduce programming and commissioning time for contractors.

- Reduce energy consumption by making systems less dependent on proper implementation and commissioning of control sequences. For example, research has shown that optimized control sequence for chilled water plants can reduce energy use by as much as 20%[v].

- Reduce energy consumption by ensuring that proven, cost effective strategies, including those required by ASHRAE standards and building codes, are fully implemented.

- Reduce energy consumption and reduce system down-time by including diagnostic software to detect and diagnose system faults and make operators aware of them before they cause performance problems.

The sequences will be maintained by SGPC 13 using the ASHRAE continuous maintenance procedure to ensure that new ideas are incorporated and bugs are identified and fixed.

Justification and Value to ASHRAE

ASHRAE members will benefit due to the reduced time to prepare, program, and commission control systems, as noted above. It is expected that most DDC system manufacturers will program the ASHRAE sequences into their systems so that they can be used or easily adapted for most any HVAC system application, reducing the cost and improving the performance of DDC systems.

Objectives:

This research project is the second of two phases:

> Phase I: Air Distribution and Terminal Systems

> Phase II: Central Plants and Hydronic Systems

Phase I was completed in June 2013.

The research plan will include basic research to determine optimum sequences for chilled water plants expanding on the work by Taylor 2012. This will comprise about 30% to 50% of the RP cost.

Other sequences will be obtained from the literature, control system and boiler/chiller manufacturers, and sequences developed by the contactor from past projects.

The best of the sequences will be merged into a detailed package for the most common applications. The sequences would be annotated to explain the reason behind the control logic − this is something that is missing from most sequences but very helpful to engineers who are editing the sequences for their projects.

Logic flow diagrams will be developed for the sequences so that the logic is not vague, as is inherent in any written sequence.

As a final step in the research, the sequences will be implemented in a real system in a real building for proving and debugging.

Once the research project is complete, the sequences and flow diagrams will be proposed as appendices to Guideline 13 via the addenda process. This will allow them to be publicly reviewed to further ensure they are complete and bug-free. Including the sequences in Guideline 13 will also allow them to be maintained over time, such as fixing bugs and incorporating new energy saving or diagnostic sequences via addenda, and also provides a good way for them to be disseminated − control sequences and control specifications go hand in hand.

Key References:

[i] ASHRAE Standard 90.1 *Energy Conservation in New Buildings except Low rise Residential Buildings*
[ii] Hartman, T. (2005). *Designing Efficient Systems with The Equal Marginal Performance Principle*. ASHRAE Journal, 47, 64-70.
[iii] Hydeman, M. and Zhou, G (2007). *Optimizing the Control of Chilled Water Plants*. ASHRAE Journal, 48, 45-54.
[iv] *CoolTools™ Chilled Water Plant Design and Performance Specification Guide*, Pacific Gas & Electric Co.
[v] Taylor, S. (2012), *Optimizing the Design and Control of Chilled Water Plants Part 5: Optimized Control Sequences*, ASHRAE Journal, June 2012

Guideline xxx: High Performance Sequences of Operation for HVAC Systems

1. PURPOSE: The purpose of this guideline is to provide standardized high performance sequences of operation for heating, ventilating, and air-conditioning (HVAC) systems.

2. SCOPE:

2.1   This guideline provides detailed sequences of operation for HVAC systems that are intended to:

- Maximize energy efficiency
- Meet ASHRAE standards such as Standard 62.1 and Standard 90.1
- Provide realtime fault detection and diagnostics
- Provide stable control of space environmental conditions and HVAC systems and equipment

2.2   Sequences in this guidelines are expressed in both English language format (for engineers and operators to understand their intent) and logic flow diagrams (for unambiguous application by control system programmers).

2.3   This guideline also provides functional tests that can be used to confirm proper implementation of the sequences in control systems.

Attachment 9 – TC 1.4 Program Subcommittee Minutes

Attachment 9 – TC 1.4 Program Subcommittee Minutes

TC 1.4 – PROGRAM SUBCOMMITTEE
ASHRAE SUMMER MEETING DENVER
JUNE, 2013

The subject meeting was held on Sunday, June 23, 2013 starting at 5:00 PM following the Components and Control Applications Subcommittee meeting. The attendees remained. The sign-in sheet is attached.

Programs Presented in Denver:

1. *SPECIAL SESSION 4 Chaired by Frank Shadpour*
   Sunday, 8:00 AM-9:00 AM - Governors Square 14
   BIM, Commissioning, and COBie: Does Automated Building Energy Modeling Replace Measurement and Verification?

2. *SEMINAR 10: Chaired by Marcelo Acosta*
   Monday, 8:00 AM-9:30 AM - Plaza Ballroom E
   Control Your Costs and Expand Your Possibilities: Integrating Factory-Mounted Controls

3. *Technical Paper: Report on RP1597 "Stochastic Optimal Control of Mixed Mode Buildings"   Author: Ryan Tanner of the U of Colorado,*

Anticipated Programs for Denver That Did Not Take Place:

None

Programs Proposed for New York Winter Meeting,   January 18-22, 2014

1. *Seminar: Chaired by Chariti Young, Track 6*
   Integration for successful Operation: Show me what I need to know.

2. *Seminar: Chaired by Joseph Kilcoyne, Track 4*
   Integration for successful Operation: Avoiding the recipe for disaster.

3. *Seminar: Chaired by Jin Wen*
   RP-1353, Stability and Accuracy of VAV Box Controls at Low Flows

4. *Forum: Chaired by Barry B Bridges*
   Controls Training: What's needed for the industry?

5. *Seminar: Chaired by Steve Taylor, Track 4*
   "Demand controlled ventilation for multiple zone systems: problem solved." RP 1547
   Cosponsor; TC-4.3

6. *Seminar: Chaired by Jim Coogan , Track 6*
   Performance Rating Standards for Buildings and BAS

7. *Seminar: Chaired by Kimberly Barker , Track 4*
   Automated Demand Response in Commercial Buildings

Programs Proposed for Seattle Summer Meeting,   June 28 - Jul 2, 2014

1. *Conference Paper Session: Chaired by Frank Shadpour*
   Controlling a Minimum Impact Data Center

2. *Conference Paper: Chaired by Mark Hydeman*
   ASHRAE's RP 1455: Best of Class Control Sequences for Air Systems

Program "Pipeline" for Future Meetings:

1. *Technical (Conference) Paper:* "Control Sequences within an Energy Simulation Program" (Are controls being applied properly in simulation programs) Phil Haves.

2. *Seminar / Symposium:* "Control Strategies for Museums and Libraries"
   Chaired by: Dave Kahn

3. *Seminar:* "Valves and Actuators: Are they Smart Mechanical Devices or Control Components?" Steve Linn

4. *Seminar:* "Building Automation System for Data Centers". Dave Kahn

5. *Seminar / Symposium:* "Optimization and Controls of VAV Systems to Meet ASHRAE 62.1" Chaired by Steve Taylor

6. *Seminar:* "Wireless DDC Technology – Real Applications". Frank Shadpour

7. *Seminar:* "Be Alarmed at what your BAS is not Telling You: Is no news really good news?" Chaired by Kimberly Barker

8. *Technical Paper:* "Proactive Energy Performance Optimization" *Chaired by:* Jim Tello

9. Seminar. "Control Specification Fundamentals, How to Get What You Really Want" Larry Fisher.

10. Web-Services. XML, SOAP: How Do I Get Non-Traditional BAS Information and Use It for My Building Automation.

11. Control of Geothermal HVAC Systems,

2014 New York Winter Meeting

Programs Tracks:

Track 1:   HVAC&R Systems and Equipment

Track 2:   HVAC&R Fundamentals and Applications

Track 3:   Environmental Health through Indoor Environmental Quality

Track 4:   Building Information Systems: Integrating Technology for Control, Management,
Optimization and Efficiency

Track 5:   International Design

Track 6:   Building Performance and Commissioning for Operation and Management

Track 7:   Hydronic System Design for Efficiency and Large Buildings

Track 8:   Tall Buildings: Performance Meets Policy

Deadlines:

- June 3 – August 13:   Program Proposals Accepted online
- July 2, 2013:   Conference Papers for Ney York (If abstracts were accepted)
- Sep 23,2013:   Conference Paper Abstracts for Seattle
- Jan 9,2013:   Conference Papers for Seattle

Presentations and Guidelines:

1. *Conference Paper vs. Technical Paper:* Conference paper is limited to eight (8) pages, the timeline is shorter and the review process less rigorous than the technical papers currently presented in the Technical Paper Sessions.

2. *Seminar and Forum Submissions:* For Seminar submissions, they should include six (6) Learning Objectives and ten (10) Questions and Answers for the session.

3. *Seminar Program Submission:* 60 minutes (1-2 speakers) or 90 minutes (3-4 speakers).

4. *Speakers (session chairs, forum moderators, presenters) will receive a 75% reduction on their registration. The Speaker registration fee is $95.*

5. *Students and student branch advisors will pay a nominal registration fee of $25.*

6. *The ASHRAE Board of Directors and CEC will receive a 75% reduction on their registration.*

Upcoming Meetings:

New York   Jan 18-22, 2014

Seattle   Jun 28-Jul 2, 2014

Chicago   Jan 24-28, 2015

Atlanta   Jun 27-Jul 1, 2015

Orlando   Jan 23-27, 2016

St. Louis   Jun 25-Jun 29, 2016

Note:
- *Conference Paper vs. Technical Paper:* Conference paper is limited to eight (8) pages, the timeline is shorter and the review process less rigorous than the technical papers currently presented in the Technical Paper Sessions.
- *Seminar and Forum Submissions:* For Seminar submissions, they should include six (6) Learning Objectives and ten (10) Questions and Answers for the session.
- *Seminar Program Submission:* 60 minutes (1-2 speakers) or 90 minutes (3-4 speakers).

These minutes stated herein were approved by TC1.4 program subcommittee on Sunday, June 23, 2013.

Submitted by: Frank Shadpour, PE
TC1.4 Program Subcommittee Chair.
frank@scengineers.net