

# Coordinating Research Council 2016 Air Quality Modeling Research Needs Workshop

February 9-10, 2016  
Atlanta, GA

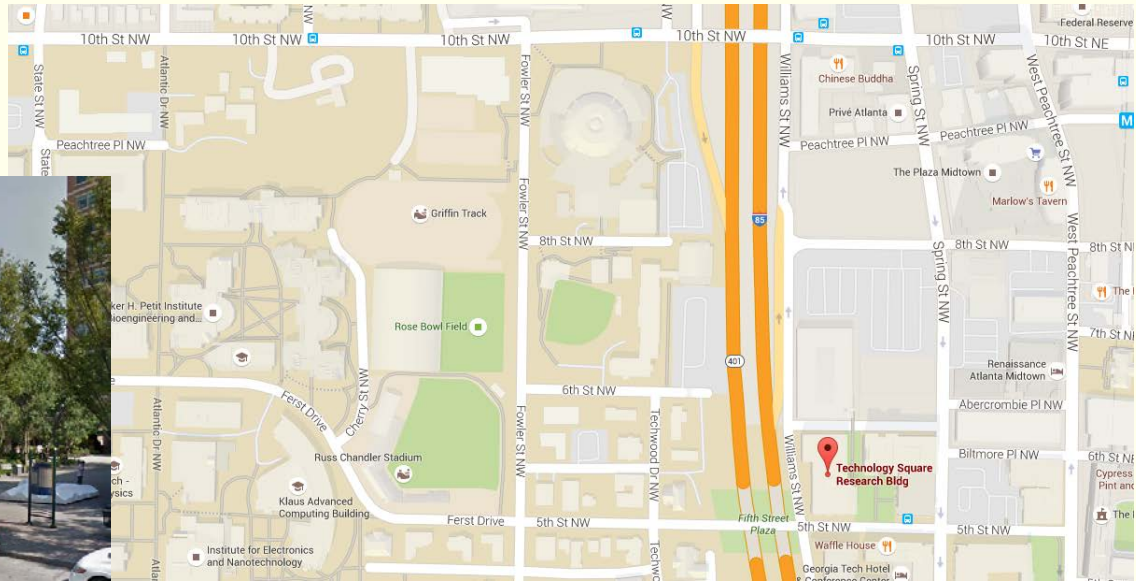
**Randall Guensler**  
Georgia Institute of Technology  
School of Civil and Environmental Engineering



# Georgia Tech Campus Location

## Technology Square Research Building (TSRB)

85 5th Street NW  
Atlanta, GA 30308



<http://www.google.com/maps>

# Background and Introductions

9:00 am - 9:30 am

# Conference Goals

- **Generate a list of priority research needs statements suitable for generating requests for research proposals (RFPs)**
- **Research needs statements will stop short of identifying the specific research methods, research approaches, or field activities that will likely need to be employed in the research**
  - **Set the stage for the development of RFPs**

# Research Needs Statement Content

- **Project Title**
- **Problem Statement** (1 paragraph)
  - Establishes the need for the research
  - Provides basic information regarding the current deficiency in science, planning, or policy tools
- **Proposed Research** (1 paragraph)
  - General description (specifics will be added later)
- **Cost Estimate** (will be added later)
- **Duration** in months (will be added later)

# Conference Objectives

- **Participating technical and policy experts will create as large a list as possible of potential research needs**
  - **Brainstorming processes**
- **Experts will discuss the research needs, refine potential issues, and clarify research needs**
- **Experts will participate in a series of voting processes to help identify the most pressing needs within and across general categories**
- **Participants develop 30 research needs statements**

# Research Needs Categories

- **Three research needs groups are convening:**
  - **MOVES and inventories**
  - **Regional air quality modeling**
  - **Secondary pollutant formation**

# Scope of Research Needs

- **Given the CRC's charter, the scope will be limited to pollutant emissions, formation, and concentrations**
  - **System impacts and externalities are excluded (e.g., well-to-wheel, lifecycle analysis, equity and socioeconomic impacts, etc.)**
  - **Potential downstream impacts are excluded (e.g., microscale dispersion, health impact assessment, global warming, etc.)**



# RNS Development Process History

- **Transportation and Air Quality Workgroup (2002). “2002 Air Quality Research Needs Statements.” Proceedings of TRB Conference 28. Environmental Research Needs in Transportation Invitational Conference. National Research Council. Washington, DC. March 2002.**
- **Transportation and Air Quality Workgroup (1997). “1996 Air Quality Research Needs Statements.” Environmental Research Needs in Transportation Invitational Conference. National Research Council. TRB Circular 469. Washington, DC. March 1997.**
- **Transportation and Air Quality Workgroup (1992). “1992 Air Quality Research Needs Statements. Environmental Research Needs in Transportation.” Invitational Conference. National Research Council, TRB Circular 389. Washington, DC. March 1992.**

# Research Needs Statements Example

## TRB Circular 389, Air Quality 4 (1992)

- **Title: Modal Emission Factor Development**
- **Research indicates that “off-cycle” driving patterns may be responsible for significant amounts of uncertainty in current emission factor models....**
- **Analyze available modal emissions data to determine the extent to which high speeds and acceleration rates may affect current emission factors. Design and establish emission testing methods to quantify emissions at idle and very low speed operation, as well as high speeds and high acceleration rates.**

# Workshop Overview

- **High-intensity, high-energy working meeting**
- **Work in teams by research theme and as a whole**
- **Today we will brainstorm research ideas, discuss research needs, combine and refine ideas, prioritize ideas, and prepare to report to the group tomorrow**

# Day 1 Activities

- Preliminaries
- Invited presentations to set the stage
- Brainstorming overview, logistics, and lunch
- Big picture brainstorming (all hands) all topics
- Group brainstorming (breakout groups by topic)
  - Elaboration and group balloting
- Develop PowerPoint presentations for Day 2
- Pre-dinner mixer (dinner on our own)
- Overnight preparation of two-paragraph statements

# Day 1 Schedule, Morning

Start	End	Activity	Location
8:00 am	9:00 am	Registration and open breakfast	Reception Area
9:00 am	9:30 am	Round-robin introductions	Main Room
9:30 am 10:00 am	10:00 am 10:30 am	Invited presentations: MOVES and Inventories, Regional Modeling	Main Room
10:30 am	10:45 am	Break	Reception Area
10:45 am	11:15 am	Invited presentation: Secondary Pollutant Formation	Main Room
11:15 am	11:30 am	Orientation to brainstorming	Main Room
11:30 am	11:45 am	Logistics for the day	Main Room
11:45 am	1:00 PM	Lunch	Local Area

# Day 1 Schedule, Afternoon

Start	End	Activity	Location
1:00 pm	2:00 pm	Initial brainstorming to identify and to discuss big picture issues	Main Room
2:00 pm	2:15 pm	Move to breakout sessions	Reception Area
2:15 pm	4:15 pm	Breakout brainstorming sessions For specific research needs	Breakout Rooms
4:15 pm	4:30 pm	Flipchart balloting Identify top 10 needs	Breakout Rooms
4:30 pm	5:00 pm	Develop PowerPoint talking points for day 2 presentations	Breakout Rooms
4:30 pm	5:00 pm	Break	On Your Own
5:30 pm	7:00 pm	Pre-dinner mixer	GT Hotel
Overnight	Overnight	Group-selected volunteers will develop one-paragraph needs statements	

# Day 2 Activities

- **Preliminaries**
- **Revisit the big picture priorities**
- **Presentations by breakout groups and discussions**
  - **Questions, comments, and input will be used to refine the 30 research needs statements**
  - **Participant balloting will help the CRC identify relative priorities across major categories**
- **Final discussions**
- **Closing and adjourn (lunch on our own)**

# Day 2 Schedule, Morning

Start	End	Activity	Location
8:00 am	9:00 am	Open breakfast Collect presentations and needs statements	Reception Area
9:00 am	9:15 am	Welcome back Revisit big picture priorities	Main Room
9:15 am 9:45 am	9:45 am 10:15 am	First two breakout group presentations Questions and comments	Main room
10:15 am	10:30 am	Break	Reception Area
10:30 am	11:00 am	Final breakout group presentation Questions and comments	Main room
11:00 am 11:15 am	11:15 am 11:30 am	Discussion Break and flipchart balloting	Main Room and Reception Area
11:30 am	12:00 pm	Open discussion of results	Main room
12:00 pm	12:15 pm	Closing and logistics for next steps	Main room



# Invited Presentations

## MOVES and Inventories Regional Modeling

9:30 am - 10:00 am MOVES and Inventories

10:00 am - 10:30 am Regional Modeling

# MOVES and Inventories

- **Megan Beardsley**  
**Environmental Scientist**  
**U.S. EPA, Office of Transportation & Air Quality,**  
**Assessment & Standards Division**

Megan has worked on mobile source emission model development for many years. Currently she is the team leader for the EPA MOVES model. Previously she was the team leader for EPA MOBILE6 model. She has also worked on the NONROAD model and on emission inventory development. Prior to her years at OTAQ, she worked in the office of EPA Region V.

# Secondary Pollutant Formation

- **Shaokai Gao**

**Associate Scientist**

**Air/CO<sub>2</sub> Group, Phillips 66 Research Center**

Shaokai Gao received his Ph.D. in Environmental Science from the Chinese Academy of Sciences, Research Center for Eco-Environmental Sciences in 2009. From 2009 to 2012, Dr. Gao served as a postdoctoral research associate in the Combustion Kinetics lab at University of Southern California, where he built a crossed-molecular particle beam apparatus to study jet fuel combustion kinetics. From 2012 to 2013, Dr. Gao served as a postdoctoral research associate in the Atmospheric Process lab at University of California, Riverside, where he studied formation and composition of anthropogenic and biogenic aerosols using environmental chamber facilities. In 2013, he became an associate scientist in the Air/CO<sub>2</sub> group at Phillips 66 Research Center to help the business units on air issues.

# Break

10:30 am - 10:45 am Break

# Invited Presentations

## Secondary Pollutant Formation

10:45 am - 11:15 am Secondary Pollutant Formation

# Regional Air Quality Modeling

- **Dr. Jonathan Pleim**  
**Branch Chief**

## **Atmospheric Model Development**

**Dr. Pleim earned a Ph.D. in Atmospheric Science from the State University of New York at Albany where he developed the first nested grid version of the Regional Acid Deposition Model (RADM) and a new Planetary Boundary Layer (PBL) - Asymmetric Convective Model (ACM). Dr. Pleim has developed or improved many components of meteorological (MM4, MM5, WRF) and air quality models (ADOM, RADM, and CMAQ). He also developed the Pleim-Xiu land surface Model (PX LSM) incorporated in both MM5 and WRF, and the ACM2 PBL model in WRF. He has developed dry deposition and bi-directional surface flux models for the Community Multiscale Air Quality (CMAQ) model. Dr. Pleim has worked on the development and evaluation of comprehensive modeling systems for air quality research and assessment, air quality forecasting, regional climate, and 2-way interactive meteorology and air quality model systems. He supervises 15 scientists and leads the development of the CMAQ model and the 2-way coupled WRF-CMAQ modeling system.**

# Introduction to Brainstorming Activities

**Randall Guensler**

11:15 am – 11:30 am

11:15 am – 11:30 am

# Brainstorming Goal

- The only goal of the brainstorming activity is to generate as many ideas as possible
  - In our case, we are generating research need ideas
- The facilitator's goal is to help ensure that participants understand the brainstorming goal and that participants positively contribute to the goal



# Brainstorming Canons

- **Quantity is the goal, not quality**
- **Don't worry about any cost or technology barriers**
- **There are no bad ideas**
- **Wild and crazy ideas are completely acceptable**
- **We may improve on ideas already on the list**
- **Nobody will be called upon to contribute an idea**
  - **You were selected because of your expertise**
  - **We do not believe anyone in this group is 'shy'**

# Brainstorming Rules

- **Criticism or praise of any research needs ideas are not allowed in any form**
- **We need to check our egos at the door**
- **No prolonged discussion during brainstorming**
  - **Questions, answers, and responses should only seek to clarify the research need**
- **No war stories!**
- **No cell phones, whispering, or other distractions**
- **The facilitator will remind us of these rules as we go**

# Methodology

- **Three breakout groups by theme will convene for a brainstorming session**
- **Note takers will participate in each session to help the team get ideas down on flip chart paper**
- **The divergent brainstorming phase will be followed by a convergent phase to refine and consolidate research needs ideas, then each group will prioritize the research needs and report back to the conference**

# Divergent Brainstorming Phase

- **Active group brainstorming**
  - **Generate as many ideas as possible**
  - **Quick-fire sessions will generate list items**
  - **One person speaks at a time**
  - **Don't worry about duplication, that's handled later**
  - **Interspersed breaks will be used to add keywords and/or one-sentence descriptions to items**

# Convergent Phase

- **After the group has generated a laundry list of research needs ideas, each team will seek to:**
  - **Clarify needs**
  - **Expand or delete parts of an idea as needed**
  - **Consolidate multiple needs into single items**
  - **Break unwieldy items into multiple needs**
  - **Consider organizing needs into categories**

# Discussion Phase

- **Participants now focus on discussing the merits of individual research need ideas**
  - **Discussion about why a topic is important**
  - **Linkages to other important topics**
  - **Why other research outcomes may be affected**
  - **Discussion of relative importance**
- **Goal: Facilitate informed voting**

# Prioritization Phase

- **Each breakout session will vote on their research needs statements to identify their top ten research needs for research needs statement development**
- **Each member will cast multiple ballots**
- **Ballots will be tallied and the top ten prioritized needs will be taken to the final stage**
  - **Volunteers will develop two-paragraph statements for each selected topic overnight**
  - **The facilitator will seek volunteers**

# Brainstorming Session Schedule (±)

- **Two hour (120-minute) session**
- **5-minute warm-up**
- **35-minute initial brainstorming session**
  - **5-minute break (rotate positions)**
- **20-minute convergence session**
  - **10-minute break (rotate positions)**
- **20-minute keyword/sentence development**
  - **5-minute break (rotate positions)**
- **20-minute pre-voting discussion of merits**



# Voting Procedures

- **Research needs are listed on flipchart paper**
- **Participants cast votes for the research needs that they believe are the most critical**
- **Each participant receives a sticker sheet with colored dots representing a number of votes:**
  - **Red = 3 votes, each participant receives 5 dots**
  - **Orange = 2 votes, each participant receives 5 dots**
  - **Yellow = 1 vote, each participant receives 5 dots**
- **Each participant may only place one dot per item**

# Logistics

11:30 am - 11:45 am

# Day 1 Schedule, Afternoon

Start	End	Activity	Location
1:00 pm	2:00 pm	Initial brainstorming to identify and to discuss big picture issues	Main Room
2:00 pm	2:15 pm	Move to breakout sessions	Reception Area
2:15 pm	4:15 pm	Breakout brainstorming sessions For specific research needs	Breakout Rooms
4:15 pm	4:30 pm	Flipchart balloting Identify top 10 needs	Breakout Rooms
4:30 pm	5:00 pm	Develop PowerPoint talking points for day 2 presentations	Breakout Rooms
4:30 pm	5:00 pm	Break	On Your Own
5:30 pm	7:00 pm	Pre-dinner mixer	GT Hotel
Overnight	Overnight	Group-selected volunteers will develop one-paragraph needs statements	

# Lunch

11:45 am – 1:00 pm

# General Afternoon Session

1:00 pm – 2:00 pm

# Multidisciplinary Uncertainty Impacts

- **Each participant submitted a pre-conference form and identified a critical research need in their area**
  - **Anonymous, but tracked by theme**
- **Group homework follow-up activity:**
  - **Each participant receives a homework assignment from a participant in another theme**
  - **Write in the box how this critical research gap may affect your research or policy activities**
- **Participant discussion**

# Big Picture Idea Generation

- **Given the potential impacts of uncertainty across disciplines, are there any big picture issues that we should try to make sure are covered by individual or multi-disciplinary research activities?**
- **General brainstorming**
- **We will revisit these ideas at the end of the conference to see how we did**

# Move to Breakout Sessions

**MOVES and Inventories  
Regional Air Quality Modeling  
Secondary Pollutant Formation**

2:00 pm – 2:15 pm



# Breakout Sessions

**MOVES and Inventories  
Regional Air Quality Modeling  
Secondary Pollutant Formation**

2:15 pm – 4:30 pm

# Brainstorming Rules Reminder

- **No criticism or praise of any research needs ideas**
- **No prolonged discussion during brainstorming**
  - **Clarity is desired before moving on to next idea**
  - **Questions, answers, and responses should only seek to clarify the research need**
- **No war stories!**
- **No cell phones, whispering, or other distractions**
- **Quantity, not quality**
- **There are no bad ideas....**

# Brainstorming Session Schedule

- **5-minute warm-up**
- **35-minute initial brainstorming session**
  - **5-minute break (rotate positions)**
- **20-minute convergence session**
  - **10-minute break (rotate positions)**
- **20-minute keyword/sentence development**
  - **Goal: Make sure the ideas are understood**
  - **5-minute break (rotate positions)**
- **20-minute pre-voting discussion of merits**

# “There are No Bad Ideas” Warmup

- Five minute brainstorming warmup
- How many BAD ways can we generate to redesign this coffee cup?

Source: Bad Ideas Welcome!

Scannell, M. and M. Mulvihill. The Big Book of Brainstorming Games. McGraw Hill. 2012

# 15-Minute Voting Session

- **Participants cast votes for the research needs that they believe are the most critical**
- **Each participant will receive a sticker sheet where colored dots represent a number of votes**
  - **Red = 3 votes, each participant receives 5 dots**
  - **Orange = 2 votes, each participant receives 5 dots**
  - **Yellow = 1 vote, each participant receives 5 dots**
- **Each participant may only place one dot per item**

# Development of Breakout Session Talking Points for Day 2 and Homework Assignment

4:30 pm – 5:00 pm

# Develop Talking Points for Day 2

- **30-minute group exercise to develop talking points**
- **Facilitator creates PowerPoint slides**
  - **Live, and on screen, with group input**
- **Presentation content:**
  - **Group title (1 slide)**
  - **Process and outcome (2-3 slides)**
  - **Big picture issues identified (2-3 slides)**
  - **Top ten research needs (10 slides)**
  - **Conclusions (1-2 slides)**

# Overnight Homework Assignments

- Breakout group volunteers prepare draft research needs statements on a template for the top ten research needs identified by the group
  - Project Title
  - Problem Statement (1 descriptive paragraph)
    - Why this research is needed
    - Basic background information on the deficiency in science, planning, or policy tools
  - Proposed Research (1 descriptive paragraph)



# Break for Pre-Dinner Mixer

5:00 pm – 5:30 pm

# Pre-Dinner Mixer

Georgia Tech Hotel

5:30 pm – 7:00 pm

# Day 2

9:00 am – 12:15 pm

# Day 2 Schedule

Start	End	Activity	Location
8:00 am	9:00 am	Open breakfast Collect presentations and needs statements	Reception Area
9:00 am	9:15 am	Welcome back Revisit big picture priorities	Main Room
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11:30 am	12:00 pm	Open discussion of results	Main room
12:00 pm	12:15 pm	Closing and logistics for next steps	Main room

# Day 2

## Warm-up Session

9:00 am – 9:15 am

# Revisit Big Picture Brainstorming List

- **Warm-up: Review the big picture list from Day 1**
  - Open discussion
  - How did we do?
    - **Input from each breakout session**

# Breakout Session Presentations

## MOVES and Inventories Regional Modeling

9:15 am - 9:45 am

9:45 am - 10:15 am

# Break

10:15 am – 10:30 am



# Breakout Session Presentation

## Secondary Pollutant Formation

10:30 am – 11:00 am

# Open Discussion of Breakout Results

## Discussion on Cross-linkages

11:00 am – 11:15 am

# Final Voting Session Prioritization of 30 Projects

11:15 am – 11:30 am

# 15-Minute Break and Voting Session

- **Participants cast votes for the research needs that they believe are the most critical**
- **Each participant will receive a sticker sheet where colored dots represent a number of votes**
  - **Red = 3 votes, each participant receives 5 dots**
  - **Orange = 2 votes, each participant receives 5 dots**
  - **Yellow = 1 vote, each participant receives 5 dots**
- **Each participant may only place one dot per item**

# Open Discussion of Voting Results

11:30 am – 12:00 pm

# Closing Session

**Brent Bailey, CRC**

12:00 pm – 12:15 pm