AMSG Strategic Planning Workshop Summary and Outcomes

Allison McComiskey & Doug Sisterson, AMSG Co-Chairs
AMSG Strategic Planning Workshop Participants

AMSG Strategic Planning Workshop
Argonne National Lab, Chicago, IL,
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ARM Aerosol Measurement Science Group Charter

"The ARM Aerosol Measurement Science Group (AMSG) is tasked with providing ***enhanced coordination of ARM Climate Research Facility observations of aerosols and atmospheric trace gases with the needs of its Users****. Its objective is to ensure advanced, well-characterized observational measurements and data products at the spatial and temporal scales necessary for improving climate science and climate model forecasts. The primary function of the AMSG will be to* ***provide strategies to the ARM Technical Director and ARM Chief Operations Officer that can be used to implement a coherent measurement and data processing approach*** *that addresses the priority aerosol science needs of ARM and ASR. The group fulfills the need for an integrated oversight to the planning, coordination, and leadership of aerosol instrumentation selection and deployment, measurement strategy and quality, and data product development from both science and operations perspectives."*

https://www.arm.gov/about/constituent-groups/amsg

AMSG Strategic Planning Workshop Outcomes

Goal

identify an aerosol measurement strategy to align aerosol science questions with current ARM Facility instrumentation and observational capabilities

Process

evaluate the status of ARM's existing aerosol instrumentation, measurement strategies, and data products in the context of ARM and ASR science directions and the current and future needs of ARM data users

Outcomes

options for efficiently building on current ARM capabilities to address these science needs

Constraints

- Budget and existing resources
- Siting (logistics versus ideal location for science)
- Prioritization: 'Mediocre at many' vs. 'Stellar at few'

Workshop Participants

AMSG Members

- Allison McComiskey: NOAA; Co-Chair, Science
- Doug Sisterson: ANL; Co-Chair, ARM Instrument Operations Manager
- Jerome Fast: PNNL; not attending
- Manish Srivastava: PNNL; Modeling
- Stephen Springston: BNL; AOS Lead Mentor
- Connor Flynn: PNNL; Aerosol Translator
- Art Sedlacek: BNL; AOS Mentor
- Gannet Hallar: DRI; Science; ARM UEC
- Chongai Kuang: BNL; AOS Mentor
- Mike Ritsche: ANL; ARM Instrument Engineering Manager, SGP
- Allison Aiken: LANL; FIDO (ENA/AMF1/AMF2)
- Josh King: University of Oklahoma; AOS data quality
- Fred Helsel: SNL; NSA/AMF1, not attending

External Invitees

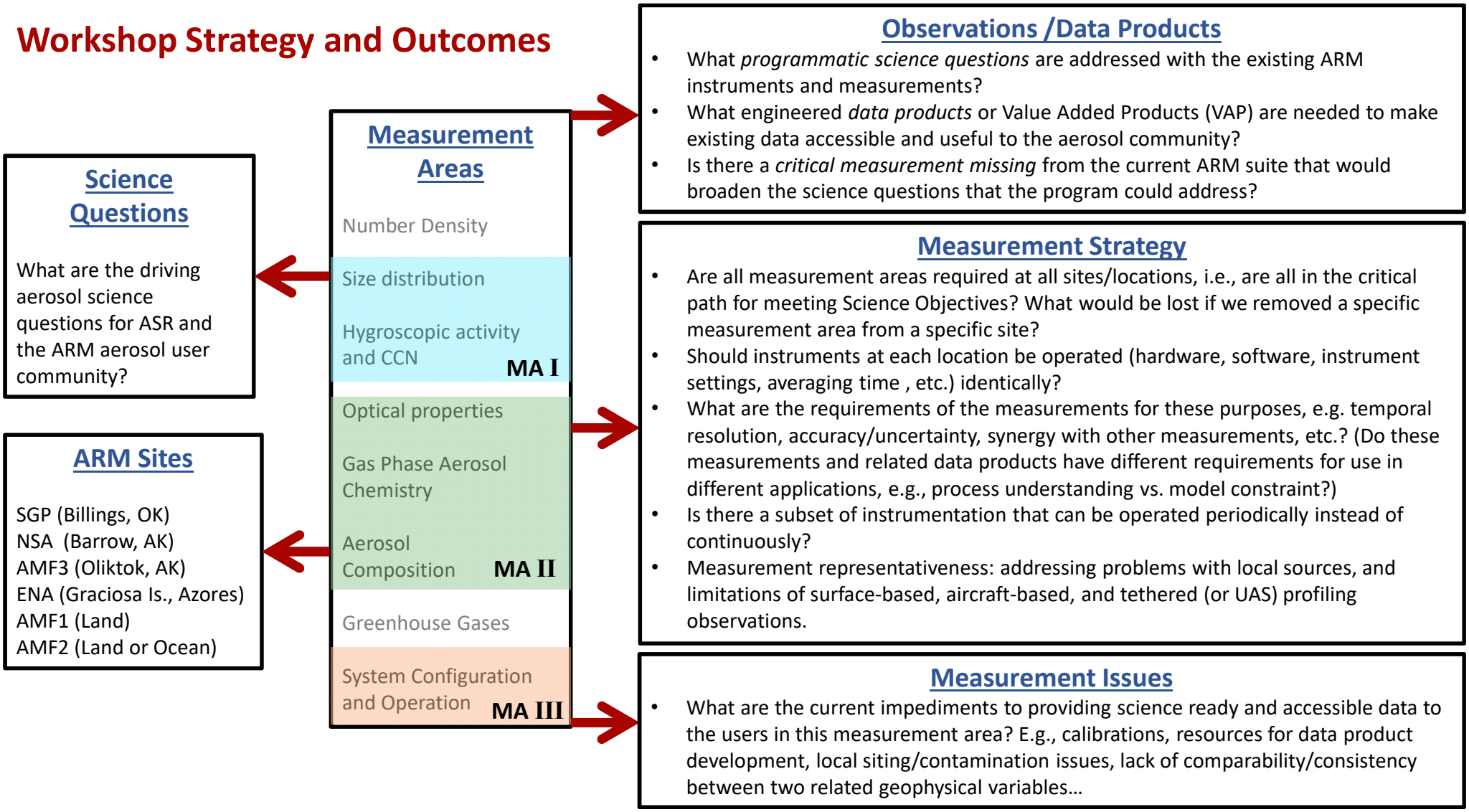
- Jim Mather (PNNL): ARM Technical Director
- Jimmy Voyles (PNNL): ARM Chief Operating Officer
- Tim Onasch: Aerodyne
- Ernie Lewis: BNL
- Don Collins: Texas A&M
- Qi Zhang: U of California-Davis)
- Gavin McMeeking: Handix Scientific
- Kerri Pratt: U of Michigan
- Yan Feng: ANL

Call-In Participants

- Nicole Riemer: U of Illinois; ALWG Co-Chair
- Jim Smith: U of California, Irvine; ALWG Co-Chair
- Jian Wang: BNL
- Jessie Cremean: U of Colorado
- Patrick Sheridan: NOAA, Global Monitoring Division
- Jason Tomlinson: PNNL; ARM Aerial Facility

AOS Measurement Areas	Instruments	Measurement	Product	Issues
Number Density	CPC, CPCf, CPCu	N_{CN}	Number concentrations	
Size Distribution	SMPS-nano, SMPS UHSAS APS	Electrostatic mobility diam. Optical scattering diam.	dN/dlogDp 2-150 nm, 10-500 nm dN/dlogDp 60-1000 nm	Can different measures of size be combined across the full size range?
Optical Properties	Neph PSAP, CLAP, TAP, Aethalometer, PASS CAPS	Scattering/Backscattering Absorption Extinction	AOSAOP: σe, σs, σa, ω, g	Absorption corrections? No aeth absorption or AAE Automated closure? AE for all quantities?
Gas Phase Aerosol Chemistry	NOx Box O3 Analyzer SO2 Analyzer PILS	NO, NO_2, NOx, NOy, O3 SO2		Operational/sampling protocol? (where & when)
Aerosol Composition	Aethalometer SP2 ACSM	BC rBC SO_4, NH_4, Cl, NO_3	Mass conc & size distr OA-COMP	Effort intensive Not operational?
Hygroscopic Activity and Cloud Droplet Activation	Neph + humidograph HTDMA CCN, SFTG-CCN	f(RH) g(RH) N_{CCN}	Scatter/backscatter spectrum, 40-80% Size distribution spectrum, Number conc spectrum, 0.2-1.2 %SS	 (dev) 0.05-1.5 %SS/150 sec
Greenhouse Gases	AOS stack Flasks LiCor CO2 Flux Precision Gas System	CO_2, CH_4 CO2, CO_2, CH_4, CO_2-C^{12}, CO_2-C^{13}, CO, N_2O		
System Configuration and Operation			T, RH, Impactor function, humidograph function, flows	Heating or drying control? Size cut utility?

Workshop Strategy and Outcomes



Preliminary Outcomes – Measurement Areas *

AOS Measurement /Work Areas Ranked	Recommendations
Particle Size Distribution	• Measurement of full size distribution (incl. coarse mode) at all locations (10 nm – 20 µm) a priority • Provide merged 'science-ready' data product combining all measurement sources
System Configuration and Operation	• Sample air maintained at a consistent low RH% by *diffusional drying* and not heating • Resources for lab characterization of instruments/system by mentors needed
Optical Properties	• Consider Aethalometer (AE-33) as primary light absorption measurement (expanded λ range) • Comprehensive characterization of all filter absorption instrument correction factors • SBIR for improved *direct* absorption measurement approach needed • Add open path extinction measurement for closure to ambient conditions
Aerosol Chemical Composition	• Improved characterization of ACSM (relative to full AMS) • Partner with existing composition measurement networks (e.g., IMPROVE) to extend composition information at ARM sites at low cost (esp. refractory aerosols)
Documentation and Outreach	• Improve documentation for better data awareness and accessibility • Work more closely with ARM proposers and PIs to develop measurement strategy
Hygroscopic Activity and Cloud Droplet Activation	• Better characterization of HTDMA; develop high level data product (kappa vs. size) • Limit hygroscopicity (*f*RH) measurements to fewer RH set points for simplicity • Size-resolved CCN measurements (reconfigure system to run instruments in-line)
Gas Phase Aerosol Chemistry	• Baseline trace gas measurements at all sites: NO_x, CO, SO_2, O_3 • Run more extensive gas-phase measurements in IOP mode intermittently at appropriate ARM sites to characterize seasonal cycles

* Number concentration and CCN Measurement Areas have seen recent advances

Preliminary Outcomes – Other than Measurement Areas

- Remove instruments that are poorly understood or with large uncertainties (making use of data questionable) from operation until adequately characterized for confident operation in the field (e.g., HTDMA)
- Use SGP as a testbed for new measurement strategies and data product development – when implementation is proven, assess for extension to other sites
- Consider SGP for the most complete measurement suite for support of and use with high-resolution modeling activities – have a single highly comprehensive location for process
- Use IOP mode for intensive measurements to characterize seasonal cycles at sites
- Consistency / closure exercises recommended for number, size, composition, optical properties
- Consider moving AOS from Oliktok Point to Barrow (due to contamination @ OLI)
- Extend aerosol property information to the vertical - develop relationships from surface measurements to column integrated and vertical profiles by remote sensing:
  - evaluate representativeness of surface AOS data aloft
  - Extract more information from remote sensing approaches using knowledge from detailed in situ measurements
  - This could be validated by routine UASes, tethersondes, and aircraft field campaigns

  Monday Breakout: Bringing Remote Sensing and In Situ Measurements Together for Constraining Aerosol Radiative Forcing

Path Forward - Input and Feedback from ALWG

- ARM to craft a concrete strategy based on AMSG/Workshop Recommendations and further constraints:
  - Budget and resource availability
  - Science priorities from ASR and ALWG

- Input and Feedback from ALWG
- Parallel and complementary reporting from working group
  - Critical gaps dictated by ASR-funded science missing here
  - Prioritization based on WG science directions
  - Follow-on with survey and/or meetings

- Please provide and thoughts or comments to the AMSG:
  - https://www.arm.gov/about/constituent-groups/amsg
  - Allison McComiskey: allison.mccomiskey@noaa.gov
  - Doug Sisterson: dlsisterson@anl.gov