U.S. DEPARTMENT OF ENERGY | Office of Science

DOE/SC-ARM-13-022

Atmospheric Radiation Measurement (ARM) Climate Research Facility Management Plan

Revised April 2016

ARM

CLIMATE RESEARCH FACILITY

DISCLAIMER

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Work supported by the U.S. Department of Energy,
Office of Science, Office of Biological and Environmental Research

Acronyms and Abbreviations

AAF	ARM Aerial Facility
AMF	ARM Mobile Facility
AMSG	Aerosol Measurement and Science Group
ARM	Atmospheric Radiation Measurement Climate Research Facility
ASP	Atmospheric Science Program
ASR	Atmospheric System Research
ASST	Architecture and Services Strategy Team
COO	Chief Operating Officer
DMF	Data Management Facility
DOE	U.S. Department of Energy
DQM	Data Quality Manager
ENA	Eastern North Atlantic
FWP	Field Work Proposal
FY	Fiscal Year
IMB	Infrastructure Management Board
IOP	Intensive Operational Period
km	kilometer
LANL	Los Alamos National Laboratory
MAOS	Mobile Aerosol Observation System
NOAA	National Oceanic and Atmospheric Administration
NSA	North Slope of Alaska
OMB	Office of Management and Budget
OSS	Operations Status System
PNNL	Pacific Northwest National Laboratory
SARS	Site Access Request System
SGP	Southern Great Plains
SISC	Science and Infrastructure Steering Committee
SKIP	Self-Kontained Instrument Platform
SNL	Sandia National Laboratories
TBS	Tethered Balloon System
TWP	Tropical Western Pacific
UAS	unmanned aerial system
UEC	User Executive Committee
USAF	U.S. Air Force
USGCRP	U.S. Global Change Research Program
VAP	value-added product

Contents

Figures

1.0 Mission and Vision

Mission and Vision Statements for the U.S. Department of Energy (DOE)'s Atmospheric Radiation Measurement (ARM) Climate Research Facility

Mission

The ARM Climate Research Facility, a DOE scientific user facility, provides the climate research community with strategically located in situ and remote-sensing observatories designed to improve the understanding and representation, in climate and earth system models, of clouds and aerosols as well as their interactions and coupling with the Earth's surface.

Vision

To provide a detailed and accurate description of the earth atmosphere in diverse climate regimes to resolve the uncertainties in climate and earth system models toward the development of sustainable solutions for the nation's energy and environmental challenges.

2.0 Background

Over the last few decades, the U.S. Government has invested billions of dollars in the development of infrastructure to improve the nation's ability to stay at the forefront of scientific and technological research. As part of this investment, DOE has established several major research facilities for use by the scientific community for studying the interactions between energy use and the environment. The U.S. Global Change Research Act of 1990 established an interagency program within the Executive Office of the President to coordinate U.S. agency-sponsored scientific research designed to monitor, understand, and predict changes in the global environment. At that time, it was determined that the highest-priority area for new research was to develop an improved understanding of how clouds affect the radiation balance of the atmosphere (e.g., incoming solar radiation and outgoing infrared radiation or heat energy) and hence influence the Earth's climate.

To address the need for new research on clouds and radiation, DOE established the ARM Program (Stokes and Schwarz, 1994). Since 1990, the ARM Program has supported a combination of field measurements and modeling studies designed to improve the representation of clouds in understanding and predicting changes in the Earth's climate (Mather and Voyles 2013). Through the ARM Program, DOE has funded the development of several highly instrumented ground stations for studying cloud-formation processes and their influence on radiative transfer and for measuring other parameters that determine the radiative properties of the atmosphere.

These stations also provide enhanced sites for periodic airborne and remote-sensing studies and complement atmospheric observations being made by satellite.

The scientific infrastructure that has been created as part of the ARM Program is a valuable national and international asset for advancing scientific knowledge of Earth systems. In fiscal year (FY) 2003, DOE designated the ARM sites as a national scientific User Facility. The FY2004 budget included an

increment for enhancing the sites to provide more research capability for the global scientific community. The budget increment provided the resources to build and expand on the existing infrastructure to broaden the scientific scope of the sites and to support a larger user base. In 2009, the ARM Climate Research Facility (no longer the ARM Program) was provided $60M in Recovery Act funding to expand its measurement capabilities and to update its infrastructure. Measurement needs had been identified through a series of workshops over the preceding several years. Information about the Recovery Act upgrades is available at http://www.arm.gov/about/recovery-act. The resulting new ARM Facility has enormous potential to contribute to a wide range of interdisciplinary science in areas such as meteorology, atmospheric aerosols, hydrology, biogeochemical cycling, and satellite validation, and to provide potential monitoring sites where remote sensing and modeling related to homeland security can be validated.

The ARM Facility is currently undergoing a reconfiguration that is designed to accelerate the application of ARM observations and data processing for the understanding of key atmospheric processes and the representation of these processes in global climate models (U.S. Department of Energy 2014). This enhanced impact on the research community will be achieved by:

1. Enhancing ARM observations and measurement strategies to enable the routine operation of high-resolution models and to optimize the use of ARM data for the evaluation of these models.
2. Undertaking the routine operation of high-resolution models at ARM sites.
3. Developing data products and analysis tools that enable the evaluation of models using ARM data.

The ARM Facility has a strong collaboration with the Atmospheric System Research (ASR) Program. ASR was formed from the merger of the former ARM Science Program and the Atmospheric Science Program (ASP). In addition, as a DOE Office of Science User Facility, ARM serves the broader climate research community, and solicitations for use of the facility are open to anyone. ARM also seeks scientific input from both ASR and the broader research community to ensure that it remains responsive to the community's observational needs.

The ARM Facility supports routine as well as new field campaigns, new long-term measurement systems, new instrument testing and validation, new scientific algorithm development for adding value to instrument data, and enhanced data access. The requirements for these services are developed in cooperation with representatives of the non-ARM climate (or appropriately related) research community. While the ARM Facility does not provide direct funding for scientific research, small amounts of funding may be provided to allow the facility to assist with logistics, the development of datastreams and archiving, and other activities associated with the facility usage.

3.0 Oversight and Reporting Requirements

Oversight of the ARM Facility is provided by the DOE/ARM Program Managers within the DOE Office of Biological and Environmental Research and, through that office, a committee of scientists, engineers, and program managers are selected to review the structure, interactions, and overall performance of the Facility. This review is nominally chartered on a 3-year cycle.

As a matter of government policy, all DOE User Facilities, including the ARM Facility, have a number of reporting requirements. ARM is required to report to the DOE ARM Program Manager where accountabilities are established by the U.S. Department of Energy's Office of Biological and Environmental Research, and to the White House Office of Management and Budget (OMB). A primary requirement for ARM is the documentation of unique science users. Scientific users of the ARM Facility are peer reviewed and are counted by category. Scientific user categories include onsite, offsite, and data.

The main performance measure for site operations is the data availability for each instrument at each site. The Operations Managers, Data Management Facility (DMF) Management, and Data System Engineering activities are responsible for keeping the instruments operating as continuously as possible and keeping the data flowing to the ARM Data Archive, where the data and metadata are eventually made available to users. The Data Quality Office is responsible for data usability, ensuring that the data are of known and reasonable quality. The Data Quality Office routinely provides rigorous data-quality checks and reports problems to affected members of the operations team who could include site managers, instrument mentors, the Instrument Operations Manager, and the Chief Operating Officer. These problems are resolved as quickly as possible, and the causes and solutions to the problems are documented to help prevent any future data loss. The ARM Data Archive is the repository of all ARM data and all User Facility data. The Data Services Manager is responsible for user data accessibility.

4.0 Location and Instruments

The ARM fixed research sites represent three different climatic regimes: 1) Southern Great Plains (SGP), 2) North Slope of Alaska (NSA), and 3) Eastern North Atlantic (ENA). Respectively, these sites address a range of climatic conditions: 1) variable mid-latitude climate conditions, 2) land and land-sea-ice arctic climate, and 3) marine stratocumulus. In addition, two ARM Mobile Facilities (AMF1 and AMF2) are deployed for short-term field campaigns (approximately 1 year) at sites around the world. AMF2 is designed for deployments in a marine environment. A third mobile facility (AMF3) is currently deployed for an extended period at Oliktok, Alaska. Between 1996 and 2014, ARM operated instruments at three sites in the Tropical Western Pacific (TWP). While these sites are no longer operating, the data from these sites are available at the ARM Data Archive. The locations of the ARM fixed research sites are shown in Figure 1. Details on the specific nature of each site and the instrumentation at each can be found on the ARM web site at http://www.arm.gov/instruments/.

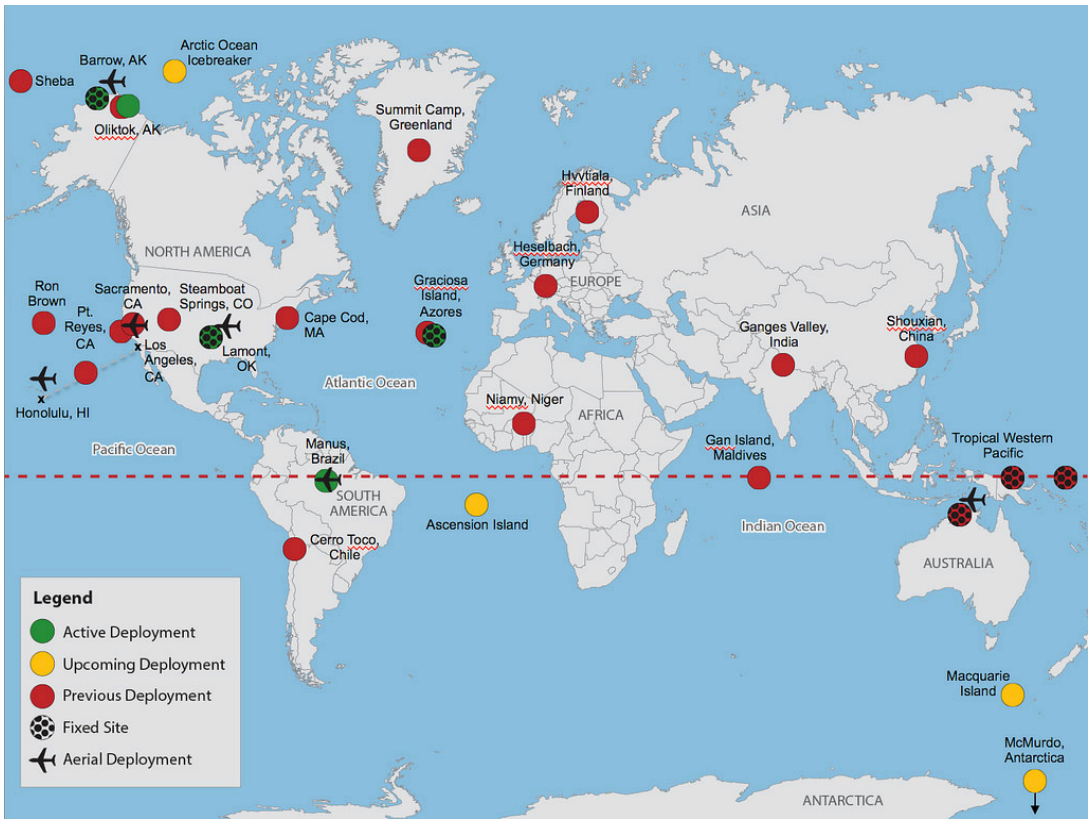

Figure 1. Locations of ARM fixed sites and mobile facility deployments.

4.1 Southern Great Plains

The SGP site consists of in situ and remote-sensing instrument clusters arrayed across north-central Oklahoma and south-central Kansas. The ARM SGP site is the largest and most extensive climate research field site in the world and can be viewed as a real observatory. The site includes a Central Facility with extensive core instrumentation. Routinely operating instruments at the Central Facility include one of the only continuously operated Raman lidars in existence; millimeter-wavelength cloud radar, micropulse lidar, microwave radiometer, and multiple radar wind profilers. These remote sensors are augmented by state-of-the-art surface radiation measurements, balloon-borne atmospheric profiling, and dutiful surface latent and sensible heat flux measurements Additional subsets of instrumentation are situated at extended facilities distributed across the SGP site. In addition to the study of clouds and radiation, scientific activity ongoing at the SGP site includes studies of the carbon, water, and energy cycles at the landscape scale and aerosols. Because the SGP site contains one of the largest collections of ground-based remote sensors and continuous measurements for atmospheric research in the world, it is an ideal site for major collaborative field projects. The site is currently being augmented to include four boundary-layer profiling sites and an improved soil moisture network to support the development of continuous model forcing data sets. The forcing data set will be used to run a high-resolution model on a routine basis to support the application of ARM observations for the improvement of global climate models. Additional measurements are also being added to support model validation. This expanded set of measurements is expected to include additional scanning cloud radars (previously deployed in the Tropical Western Pacific), upgraded in situ precipitation instruments, and upgraded soil moisture measurements. With the expanded capabilities, the site is being designated a “megasite”.

4.2 North Slope of Alaska

The NSA site is managed by Sandia National Laboratories (SNL) and provides data about cloud and radiative processes at high latitudes. Routinely operating instruments include millimeter-wavelength cloud radar, micropulse lidar, a number of radiometers, and other instruments for atmospheric profiling and measurements of surface meteorology. Data from these instruments are being used to understand cloud processes in the Arctic and to refine models and parameterizations as they relate to Arctic climate. The site consists of a facility at Barrow, Alaska, which includes a subset of the instruments available at the SGP Central Facility.

The NSA site provides a test bed for studies of climate change at high latitudes. In this region, ice (including snow) is the predominant form of condensed water most of the year, both in the air and on the surface. Ice and snow scatter, transmit, and absorb sunlight and radiant heat much differently than water. There is very little water vapor in the atmosphere, changing the impact of the atmosphere on the propagation of radiant energy, particularly radiant energy propagating upwards from the surface, and on the performance of some atmospheric remote-sensing instruments. The major "pumps" for the global ocean currents are at high latitudes, and there is good reason to believe that those pumps will be affected by climate-related changes in the atmosphere. High-latitude atmospheric processes over both land and sea must be characterized for incorporation into global climate models.

Like the SGP, the NSA, in combination with the AMF3 site at Oliktok, is being developed as a second megasite. Much of the megasite development is being carried out at Oliktok and is described in the ARM Mobile Facilities section (4.4) below. Like the SGP, the goal is to expand observational capabilities at the NSA to better support model simulations and process study research.

4.3 Eastern North Atlantic

The ENA site is located on Graciosa Island in the Azores archipelago and is managed by Los Alamos National Laboratory (LANL). The Azores are located in the northeastern Atlantic Ocean, a region characterized by marine stratocumulus clouds. Response of these low clouds to changes in atmospheric greenhouse gases and aerosols is a major source of uncertainty in global climate models. The ENA fixed-site facility returns to the site of a previous ARM Mobile Facility deployment. The previous Azores deployment lasted approximately 20 months beginning in May, 2009 and illustrated the importance of measurements in this region.

4.4 ARM Mobile Facilities

The ARM Mobile Facilities (AMFs) were designed to explore science questions beyond those addressed by ARM's current fixed sites. With instrumentation and data systems similar to the fixed sites, the AMFs are deployed to locations around the world for campaigns lasting 6 to 24 months. They are designed to operate in any environment, from the cold of the poles to the heat of the tropics. Proposed deployment sites are reviewed by the ARM Science Board based on an evaluation of the scientific and collaborative opportunities as well as projected demands on available resources.

AMF1 was initially developed in 2005 and has been deployed to Point Reyes, California; Niamey, Niger; Heselbach, Germany; Shouxian, China; the Azores, Portugal; Nainital, India; Cape Cod, Massachusetts;

and Manacaparu, Brazil. The AMF2 has similar capabilities to the AMF1 but was designed to be more modular, with a specific objective of being deployable in difficult environments, including onboard ships. AMF2 was first deployed in 2010 to the Storm Peak Laboratory near Steamboat Springs, Colorado and has subsequently been deployed to the island nation of the Maldives; on the cargo vessel *Spirit* operating between Los Angeles and Hawaii; on the National Oceanic and Atmospheric Administration (NOAA) Research Vessel *Ron Brown*; and at McMurdo Station, Antarctica. The deployment on the *Spirit* was the first marine deployment of an AMF. AMF1 and AMF2 are managed by LANL. A third mobile facility is initially deployed at Oliktok, Alaska along the Alaskan North Slope approximately 300 kilometers (km) southeast of Barrow. The AMF3 is managed by SNL and will be deployed at Oliktok for an extended term before being made available for other locales. The Oliktok site is unique in that it includes restricted air space allowing operations of tethered balloons and unmanned aerial systems (UAS) in the vicinity of the site.

The Oliktok site, in combination with the NSA site at Barrow, are being designated a second megasite, along with the SGP. Like the SGP, the goal of the megasite is to better sample the region to enable high-resolution model simulations in conjunction with the ARM observations. However, unlike the SGP, it is not currently possible to provide auxiliary ground-based measurements to sample the surrounding area. Instead, capabilities for operating UAS and Tethered Balloon Systems (TBS) are being developed to operate out of the Oliktok site. These platforms will provide spatial information about surface properties as well as vertical structure that will be important for process studies and model evaluation and development.

Operation of TBS is being managed by the AMF3 team while the UAS are managed by the ARM Aerial Facility (AAF; see section 4.5). The AMF3 team is also responsible for managing a volume of restricted air space around the Oliktok site as well as a warning area that begins off the coast of Oliktok and extends approximately 700 km north into the Arctic Ocean.

4.5 ARM Aerial Facility

As an integral measurement capability of the ARM Facility, the ARM Aerial Facility (AAF), including manned aircraft and fixed-wing UAS, is managed by Pacific Northwest National Laboratory (PNNL), and provides airborne measurements required to answer science questions proposed by the ASR Science Team and the external research community. Aircraft choice is dictated by science requirements—such as the required measurements and desired flight profile—and aircraft availability. Multiple aircraft are available to address the wide range of aircraft measurement requirements associated with atmospheric science issues. Data obtained from the aircraft are documented, checked for quality, integrated into the ARM Data Archive, and made available in a timely and consistent manner for use by the scientific community.

5.0 Management Structure

The ARM Facility management structure is designed to provide representation of the diverse facility components and representation of the user community (see Figure 2). Components of the facility are managed and operated by nine DOE national laboratories: Argonne, Brookhaven, Lawrence Berkeley, Lawrence Livermore, Los Alamos, National Renewable Energy, Oak Ridge, Pacific Northwest, and

Sandia. The facility components are managed on a day-to-day basis by the Infrastructure Management Board (IMB), which reports directly to the ARM DOE program managers. The ARM facility serves the broad international climate research community; however, there is a particularly close link between ARM and the DOE Atmospheric System Research (ASR) program. The Science and Infrastructure Steering Committee (SISC) combines the ARM IMB with leaders from ASR to facilitate communication between ARM and ASR and to provide scientific perspective on ARM and ASR activities. Like the IMB, the SISC reports directly to DOE program management. A final group that reports directly to DOE is the ARM Science Board. The science board reviews major proposals to use the facility and includes membership from both ASR and non-ASR scientists to represent this diverse user community.

5.1 DOE ARM Program Manager

The DOE Program Manager directs and empowers the ARM budgeting, planning, coordination, and management of activities within the ARM structure.

5.2 Infrastructure Management Board

The Infrastructure Management Board (IMB) consists of the Technical Director, Chief Operating Officer, Data Services Manager, Measurements Liaison, Aerial Facility Manager, and the Field Work Proposal (FWP) holders from each of the laboratories managing one or more ARM facilities. These positions are described below. The members of the IMB are responsible to DOE management for their respective ARM Facility components and serve as the primary points of contact for their respective areas. The IMB meets with the DOE Program Managers (usually via teleconference) on a weekly basis to discuss a broad range of matters pertaining to the management of the ARM Facility. The IMB is responsible for the overall ARM budget that is proposed to the DOE Program Managers for review and approval. The IMB assesses the impacts of all requests for use of the ARM Facility and screens science requests for use of the ARM Facility prior to consideration by the Science Board. It also provides information regarding the feasibility, cost, and facility impact associated with each request. The IMB works with DOE management on strategic planning using input from the user community as guidance for how to best configure the facility to serve research needs.

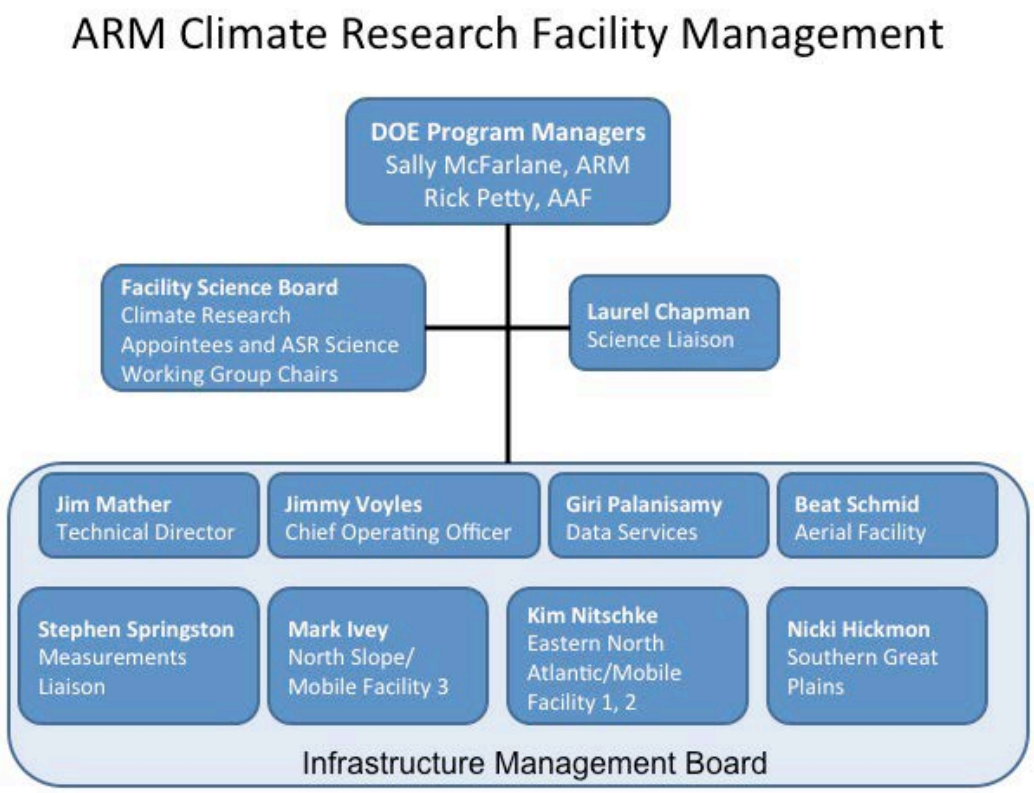

Figure 2. ARM Climate Research Facility management.

5.2.1 Technical Director

The Technical Director is the chair of the IMB, reports directly to the ARM Program Manager, and is responsible for ARM day-to-day technical activities, strategic planning, budgeting, engineering development, contracting, property management, and interactions with the science community. The Technical Director provides scientific leadership and is responsible for leading the development of the ARM vision and the strategy to achieve that vision. The Technical Director coordinates with the Chief Operating Officer and Science Liaison to plan and execute field campaign proposals. This office oversees the implementation of user requirements with the Chief Operating Officer for the operation and enhancement of the Facility. The Technical Director is responsible for the engineering services required for the operation and enhancement of the facility. Responses to review committees are coordinated through this office. The Technical Director also works with the DOE Program Manager to coordinate, plan, and implement communications with the science community, and to ensure that DOE User Facility policies and reporting requirements are followed. To develop and advance the ARM vision, the Technical Director oversees the ARM User Executive Committee, participates on the ARM/ASR Science and Infrastructure Steering Committee, and engages with the user community through a variety of forums. The Technical Director is the primary point of contact for ARM.

5.2.2 Chief Operating Officer

The ARM Chief Operating Officer (COO) is responsible for ensuring efficient, effective, and continuous operation of instruments and data systems. The COO reports to the Technical Director. The COO is responsible for coordinating the overall field campaign screening process within the IMB and for resolving user issues that might arise regarding external science projects conducted at the ARM facility. The COO serves as the communication link between the ARM IMB and the ARM Science Board. The COO works with the Technical Director to promote the use of the ARM Facility by the external scientific community. The COO works with Facility Operations Managers to ensure that appropriate cooperative relationships with international, regional, and local governments are developed in order to develop and operate fixed, mobile, and aerial sites. The COO ensures that field operations are conducted in accordance with DOE and laboratory-applicable safety and security policies. The COO is responsible for managing the user reporting system and reporting facility metrics to DOE.

5.2.3 Data Service and Operations Manager

The Data Service and Operations Manager provides management and leadership for the ARM computing environment, product delivery, and science user interaction. This includes the end-to-end definition and operational execution of collection, processing, and delivery of quality-assured measurement data products from our research sites to the ARM Data Archive and discovery and distribution to the scientific user community.

The Data Service and Operations Manager is required to lead the Architecture and Services Strategy Team (ASST), and coordinate with the Engineering Manager, Chief Operations Officer, and Technical Director to prioritize and track activity plans.

5.2.4 Aerial Facility Manager

The ARM Aerial Facility (AAF) Manager is responsible for the safe and effective operation of Aerial Measurements including manned and unmanned fixed-wing aircraft and associated measurement systems as well as coordination with ARM management, ASR science, and the general science community to define and adapt aerial measurement strategies for approved field campaigns and the Next-Generation ARM concept. Responsibilities also include the timely processing, quality assessment, and delivery of aerial measurements data to the science community.

5.2.5 ENA, AMF1, and AMF2 Site Manager

The Eastern North Atlantic (ENA), ARM Mobile Facility (AMF1, and AMF2) Operations Manager is responsible for the safe and effective management of the ENA, AMF1, and AMF2 research facility assets. This includes the associated Mobile Aerosol Observation System (MAOS), Self-Kontained Instrument Platform (SKIP), instrumentation, data systems, facilities, personnel, and ground-based and aerial support for Intensive Operational Periods (IOP). An important responsibility is the management of the cooperative relationship with local and regional stakeholders for ENA and AMF deployments.

5.2.6 NSA and AMF3 Megasite Manager

The North Slope of Alaska (NSA) Operations Manager is responsible for the safe and effective management of the Barrow and AMF3/Oliktok research facilities. This includes the instrumentation, data systems, facilities, and personnel, as well as the ground-based and aerial support for IOPs. An important responsibility is the cooperative relationship with local and regional stakeholders.

5.2.7 SGP Megasite Manager

The Southern Great Plains (SGP) Operations Manager is responsible for the safe and effective management of the SGP research facility and assets. This includes instrumentation, data systems, facilities, and personnel, as well as the ground-based and aerial support for IOPs. An important responsibility is the cooperative relationship with local and regional stakeholders.

5.2.8 Measurements Liaison

The Measurements Liaison is selected from among ARM instrument mentors and represents the ARM measurement community on the IMB.

5.3 IMB Support

5.3.1 Science Liaison

The ARM Science Liaison is responsible for coordinating the overall field campaign screening process within the IMB. The Science Liaison serves as the communication link between the IMB and the Science Board. The Science Liaison works with the IMB to promote the use of the ARM Facility by the external scientific community and to resolve user issues that might arise regarding external science projects conducted at the ARM Facility. The Science Liaison reports to the Chief Operating Officer and works closely with the Technical Directors, Facility Operations Managers, and the science community to coordinate and communicate all associated activities.

5.3.2 Technical Administrator

The ARM Technical Administrator has a variety of responsibilities associated with the operation of the ARM Technical Coordination Office. The Technical Administrator manages communications through the Technical Coordination Office, including the managing group affiliations and email lists within the People Database, delivering ARM e-newsletters and other facility messages, and managing the ARM mail moderator. The Technical Administrator also maintains facility records in the PNNL electronic records database and manages travel and other logistics for members of the Technical Coordination Office.

5.3.3 Financial Coordinator

The Financial Coordinator maintains the integrated budget, develops and maintains routine and special financial reports, and manages funding flow for ARM subcontracts.

5.3.4 Contracting and Procurements Manager

The Contracting and Procurements Manager is responsible for managing the contracting process for procurements and service contracts that are placed through the ARM technical coordination office. These include all capital procurements, instruments, and computers outside the ARM Data Center. They also include a variety of service contracts including inter-laboratory contracts. Responsibilities include maintaining regular contact with PNNL contracting staff to ensure continued progress on contracts from the request for proposals through to contract close-out, maintaining tracking documentation for contracting actions, and working with the technical director and the infrastructure management board to ensure consistency between the integrated budget and contracting actions.

5.3.5 Property Manager

The Property Manager is responsible for tagging new equipment as it comes into the ARM Facility and maintaining records for ARM property in the PNNL property database and the ARM Operations Status System (OSS). The Property Manager coordinates with mentors and staff at the observation facilities to ensure that property information in OSS is up to date.

5.4 Science and Infrastructure Steering Committee (SISC)

As a user facility, ARM serves the broad climate research community. However, ARM has a particularly close relationship with the ASR program, a sister program within the DOE Office of Science, office of Biological and Environmental Research (http://science.energy.gov/ber/research/cesd/). The ASR program supports basic research related to clouds, aerosols, and precipitation interactions based on observations from the ARM Climate Research Facility, laboratory experiments, and process modeling (http://asr.science.energy.gov).

To foster communication between ARM and ASR, DOE has established the Science and Infrastructure Steering Committee (SISC), which includes members from ARM and ASR leadership. The objectives of the SISC are to:

- • Provide scientific perspective to assist ASR Program Managers:
  - in developing an overall ASR program science vision and strategy for implementation
  - in developing strategies for evaluating and improving representation of cloud, aerosol, and radiative processes in climate models
  - in developing the agenda for the ASR Science Team Meeting.
- • Provide scientific perspective to assist the ARM Infrastructure Management Board (IMB):
  - in developing strategies to produce or decommission ARM Value-Added Products (VAPs)
  - with procurement and modifications of ARM measurement systems
  - with establishing specifications for instrument operational configurations.

The members of this committee are:

- • The co-chairs from each of the ASR Working Groups. The appointment must overlap an existing ASR grant/award.
- The leads of the site science teams for the Eastern North Atlantic and AMF3 Facilities
- • The ARM and ASR Program Managers reserve the option to appoint one or more at-large voting members.
- • Members of the IMB and the Data Quality Scientist serve as ex officio members.
- • The DOE Program Managers may reappoint committee members to additional terms.
- • The SISC Chairperson shall be appointed by the ARM and ASR Program Managers from the SISC members or at large from the pool of currently funded ASR scientists.

The SISC typically meets monthly via teleconference and twice each year in person, at the annual ASR Science Team Meeting and once during the summer.

5.5 Science Board

The objective of the ARM Science Board is to ensure that the best-quality science is conducted at the DOE User Facility known as the ARM Climate Research Facility. The goal of the User Facility is to serve scientific researchers by providing unique data and tools to facilitate scientific applications for improving understanding of climate science.

The function of the ARM Science Board is to review proposals for use of the ARM Facility. These proposals may be submitted by members of the ASR Science Team or by any other interested users of the facility, including the U.S. government agencies engaged in scientific research, colleges and universities, and other interested international scientific and educational bodies. The Science Board coordinates with the ARM IMB to assess the availability and resource requirements of the proposed facility usage. The ARM Science Board considers facility usage proposals in a timely manner to assist the scientific investigators with their proposals for funding from their prospective funding agencies.

The ARM Science Board comprises eleven members. The Board is chaired by a respected scientist in the field of climate science or a related science who is appointed by the DOE ARM and ASR Program Managers. In addition to the Chair, the Science Board includes five members from the ASR science community who represent the interests of ASR and five members who represent the interests of the broader scientific community. The DOE ARM and ASR Program Managers appoint Board members. Board business is conducted mostly by e-mail correspondence, but the Board meets formally on an annual basis. Board correspondence and meetings are facilitated by the ARM Science Liaison. Significant access requests may be deferred to consideration at the annual meeting. The Science Board Charter is available on the ARM website: http://www.arm.gov/publications/programdocs/doe-sc-arm-13-004.pdf. .

6.0 Additional ARM Facility Roles

The ARM Climate Research Facility spans the full range of activities associated with atmospheric observations, from the operation of instruments at field sites to the distribution of processed data. Functions associated with the ARM facility are carried out at nine DOE laboratories and a variety of collaborating institutions. The full ARM structure is shown in Figure 3 and is organized into four main areas:

0.0 – DOE management and groups reporting directly to DOE
1.0 – Technical coordination and engineering
2.0 – Science Liaison/Management of the field campaign process
3.0 – Operations

The organization structure shows the relationship between the management roles described in the previous section and the larger set of ARM roles and functions. The distinction between Engineering and Operations can sometimes seem blurred because often the same people are involved. However, the basic distinction between these areas is simply that Operations relates to the day-to-day activities associated with existing capabilities while Engineering involves developing new capabilities.

This document does not go into the details of all these positions; however, it does describe some of the key roles that the user community is most likely to encounter.

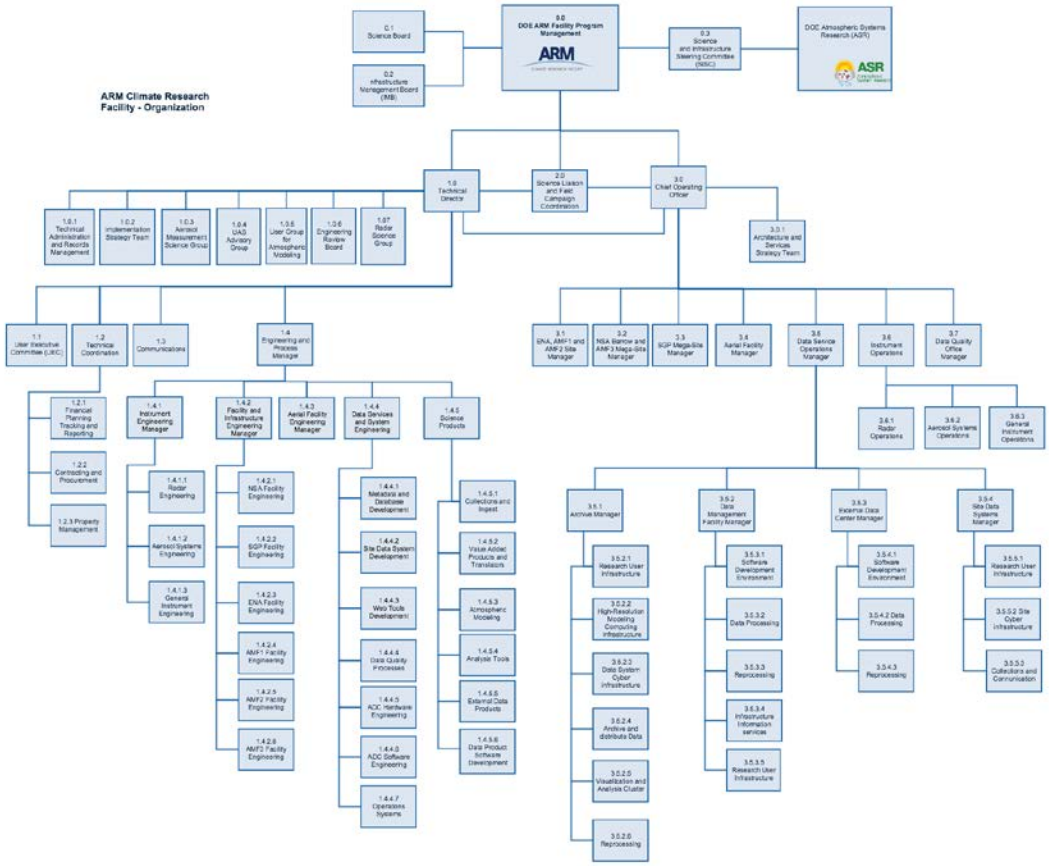

Figure 3. ARM organization.

6.1 Instrument Mentors

The ARM Facility currently operates more than 300 instrument systems that provide ground-based observations of the atmospheric column. To keep ARM at the forefront of climate observations, the ARM infrastructure depends heavily on instrument scientists and engineers, also known as Instrument Mentors. Lead Mentors must have an excellent working knowledge of their instrument systems as well as an understanding of instrument applications to studying relevant processes in order to ensure research-quality instrument performance.

6.2 Architecture and Services Strategy Team

The Architecture and Services Strategy Team (ASST) provides program-wide vision, strategy, and leadership for the ARM computing environment so that it continues to provide a flexible and extensible computing architecture and resources for high volume, high processing rates, and complex relationships between data elements.

The ARM software development and operations team is distributed across all nine DOE laboratories associated with the ARM facility. The ASST is also responsible for the representation of and communication with the software development and operations team members. The ARM ASST Manager is tasked to effectively coordinate the participation and contributions of ASST.

6.3 Data Quality Office

The Data Quality Manager (DQM) and the staff who make up the Data Quality Office provide overall guidance and management of a program to assure that the data collected at the ARM Climate Research Facility sites meet the data-quality objectives and tolerances as defined by the science user community and ARM. They also make estimates of that assurance publicly available (http://www.arm.gov/data/quality).

6.4 Translators

The ARM Science Translators are liaisons between the ARM science community and the ARM infrastructure, and are responsible for understanding community needs related to Value-Added Products. The primary responsibility of the Translators is to work with scientists and software developers to implement scientific algorithms to create robust data products that can be applied to ARM data on a routine basis. ARM Translators develop project plans that follow the VAP workflow, use ARM standards for each data development project, are required to host design reviews, and report progress to the Lead Translator.

7.0 Advisory Groups

Beginning with the radar science and operations group in 2012, several groups have been formed over the past few years for the purpose of facilitating communications between ARM and the ARM user community. Three of these groups are focused on particular measurement areas (radar, aerosol, and unmanned aerial systems) while the User Executive Committee includes representation intended to span the range of science user areas of interest. All groups report to the ARM Technical Director with the expectation of providing feedback to improve the ARM facility and its service to the user community.

7.1 User Executive Committee

The User Executive Committee (UEC or Committee) is an independent body charged with providing objective, timely advice and recommendations to the leadership of the ARM Climate Research Facility with respect to the user experience. The Committee reports directly to the Technical Director in his/her capacity as chair of the ARM Infrastructure Management Board (IMB) and serves as the official voice of the user community in its interactions with ARM management. The UEC charter defines the membership, responsibilities, and structure of the Committee.

7.2 Radar Science and Operations Groups

Cloud and precipitation radars represent the largest component of the ARM Recovery Act project. ARM now operates a network of 33 radars across the facility. The magnitude and complexity of this network has prompted the creation of a joint operations and science group to manage radar activities and to promote close collaboration between the ARM Facility and the user community. The core of the radar group is the Radar Engineering and Operations Team. This group is responsible for the operations of the radar network and the continual development of that network. For activities pertaining to site operations, the group reports to the Instrument Operations Manager. For engineering tasks, the team reports to the Instrument Engineering Manager. In addition, a radar science group represents the science community on issues related to radar applications and reports to the ARM Technical Director. The radar engineering and operations team strives to maintain close contact with the radar science team to keep the science community informed and to stay abreast of community needs.

7.3 Aerosol Measurement and Science Group

The Aerosol Measurement and Science Group (AMSG) is responsible for leading the identification of scientific performance goals, objective task prioritization, measurement gaps, data products, data processing algorithms, approaches to quality assessment, and metrics necessary to couple measurement products to the needs of the climate science community and for reporting progress toward these goals and objectives to DOE ARM and ASR Management. The AMSG as a whole will be responsible for working with the ASR and ARM science communities to identify the measured parameters and the architecture of these parameters required at the ARM Facility to improve understanding of the impact of aerosol and trace gases on climate processes that affect climate and related model simulations and forecasts. The role of the AMSG is not to set scientific priorities or objectives in aerosol research, but to provide expertise on the measurements and processes required to best meet the aerosol science objectives of the ARM and ASR programs.

7.4 Unmanned Aerial Systems (UAS) Advisory Group

The unmanned aircraft systems advisory group consists of approximately five recognized experts in UAS technology, management, and science applications who will provide scientific and technical advice to SNL and PNNL as they plan tethered balloon and UAS operations on the North Slope of Alaska, principally at the Oliktok Point ARM facility and U.S. Air Force (USAF) Oliktok Long Range Radar station. This group will possibly be asked for comments and suggestions regarding UAS deployments at other locations of interest to the DOE ARM program. The process includes a series of teleconferences and face-to-face meetings as required.

8.0 Logistics for Users

The ARM Facility is managed as a DOE User Facility despite its geographic displacement from major DOE installations. DOE guidelines for visitors and access are followed in all cases. Formal procedures are used to accommodate users at the ARM sites. Activities at the ARM Facility fall under the DOE's

safety and security policies. Therefore, requests for visits and data accounts on user data systems by foreign nationals require substantial lead time for approval.

Users conduct several major types of activities, including:

- A request for data from the ARM Data Archive
- A visit to a site (real or virtual)
- A field campaign.

All user requests are managed through the unified User Registration process.

8.1 Requests for Archived Data

Any scientist can request data from the ARM Data Archive. The request process includes the creation of an "Archive account." The creation of Archive accounts is user-initiated through the archive user interface accessible from the web. This account creation provides ARM with information about how to contact the user (email, phone number, etc.) and his/her affiliation (educational status, institutional status, etc.). The ARM Data Archive keeps detailed records about data requests that enable future reports about "who uses how much of which data types from where and over what time periods." The Archive also generates monthly reports summarizing the data volumes requested and the size of the active user community. Data from both routine and field campaign measurements are accessible, and data access is monitored by Archive operations.

8.2 Site Visits (Real or Virtual)

A request for a site visit or an account on a site data system is submitted using the Site Access Request System (SARS; http://www.arm.gov/about/forms). SARS is a collection of web-based tools used by ARM to provide advance notice of onsite visits to site managers in order to coordinate support. The system also provides the means for applicants to request and for administrators to manage access to onsite and offsite computer facilities (virtual access). Using SARS allows users to easily communicate their needs to ARM site managers and operations staff for site support and network or remote access. It also provides a method of continuing communications with ARM personnel if requirements change or if unforeseen complications or issues arise. Several types of Site and Computer Access Requests can be made. All forms are found on the ARM website and should be submitted online.

8.2.1 Physical Onsite Visit Request

A physical request submission (SARS form) is required to visit an ARM site. Advance notice of a site visit through this form is necessary to ensure the safety of onsite visitors, to help provide whatever support is needed during the visit, and to make the experience of the visitor as productive and pleasant as possible. This form also is necessary for scheduling the activities of site staff.

8.2.2 Request to Connect a Visiting (Onsite) Device (PC or Instrument) to an ARM Network

A special form is used for requesting access to an ARM network. A SARS form is also used for requesting permission to connect a PC, instrument, or other device to an ARM site network whether the requester will be present at the site or not.

8.2.3 User Account Request

A User Account Request submission is required to request a user account on a system at the DMF or at an ARM site. The DMF is the recommended location to get near-real-time access to ARM datastreams. The accounts at ARM sites are intended to provide local onsite support for visiting scientists and engineers using the facilities for scientific research, for ARM infrastructure staff, or for users requiring access to local instruments. These accounts are approved for a limited time.

8.2.4 Remote (Offsite) Network Access to any Instrument or Computer System at an ARM Climate Research Facility

This type of submission should be used to request network access to a system located on an ARM facility from a location outside the facility.

8.3 Field Campaign

A field campaign (also known as an intensive operational period, or IOP) is a research activity that is proposed, planned, and implemented at one or more research sites. ARM Facility activities that require an augmentation or change in the routine data acquisition operation of a site are designated field campaigns unless they are judged by the IMB to be primarily for the purpose of developing a new facility capability. Activities that are focused on developing new facility capabilities are tracked via the ARM Engineering Change Management System. Field campaigns range from small activities such as deployment of guest instrumentation at a research site, changes in instrument sampling strategies, or extra radiosonde launches to major activities such as an aircraft campaign or deployment of an ARM Mobile Facility.

Field campaigns may be proposed by any member of the scientific community. Information and guidelines about proposing field campaigns can be found at http://www.arm.gov/campaigns/submit-proposals. All field campaign proposals first require submission of a preproposal.

Preproposals are routed to the ARM Science Liaison, who contacts the IMB for preproposal screening. The IMB is responsible for reviewing preproposals and related facility infrastructure needs and recommending whether a full proposal should be requested. Preproposals are categorized based on the level of logistical and financial support requested and the extent to which the request might impact ongoing scientific activities. Campaigns that exceed a certain cost threshold, including AMF and AAF deployments, require submission of a full proposal and are reviewed by the Science Board. Intermediate-level campaigns may require an abbreviated proposal and be subject to peer review. The lead scientist on a preproposal is notified several weeks after submitting the preproposal as to whether a full or abbreviated proposal will be requested. Proposals are reviewed based on scientific merit and the feasibility and costs associated with User Facility use.

9.0 User Reporting Requirements

All data and data products that result from ARM-supported research are generally archived (with appropriate documentation) in the ARM Data Archive. ARM-supported data are required to be submitted and are maintained as part of the ARM Data Archive. Other data resulting from use of the ARM Facility are archived by collaborative agreement with the ARM Facility, especially if the data can be useful to a broader scientific community. ARM's data policy is derived from the policies of the U.S. Global Change Research Program (USGCRP), which encourages "free and open" access to data and research results.

Data from instruments temporarily installed at a site can also be temporarily archived and made available to a limited group of researchers who are collaborating with the principal investigator. This restricted sharing of data is only temporary. In the long term, the ARM Data Archive provides access to all data and data products developed through ARM. It includes data from field campaigns and from special studies at each of the sites and deployments of the AMF and AAF. Data submitted to the ARM Data Archive undergo strict review to ensure that only high-confidence data are accessible from the ARM Data Archive. This review requires that data are of known, reasonable, and documented quality and available in a timely manner.

Policies and procedures for data archival and release for the ARM Facility are pursuant to the USGCRP as described on the USGCRP website: http://www.globalchange.gov. Key policies include:

- Continuing commitment to the establishment, maintenance, validation, description, accessibility, and distribution of high-quality, long-term data sets.
- Full and open sharing of the full suite of global data sets for all global change researchers.
- Preservation of all data needed for long-term global change research.
- Data archives that include easily accessible information about the data holdings, including quality assessments, supporting ancillary information, and guidance and aids for locating and obtaining the data.
- Use of national and international standards to the greatest extent possible.
- Provision of data at the cost of reproduction to global change researchers in the interest of full and open data access.
- For programs in which selected principal investigators have initial periods of exclusive data use, data should be made openly available as soon as they become widely useful. In each case, the funding agency should explicitly define the duration of any exclusive-use period.

10.0 Communications and Outreach

The ARM Facility supports outreach efforts to the science community, communities located near its research sites, and to the general public. The ARM Communications Team (http://www.arm.gov/publications/contacts) is responsible for managing the ARM website, publishing ARM documents, and raising awareness in the community of ARM activities and the ARM Facility, as well as relaying scientific results and successes to the scientific community and to DOE management. The

Communications Team regularly updates the ARM website to include current events and activities at ARM sites, new research results, and a compilation of summaries of published ARM research results or other significant ARM accomplishments. The Communications Team facilitates prompt and comprehensive responses to inquiries and information requests from scientists and agency personnel and publicizes successful ARM research stories in appropriate venues. Communication specialists develop materials that provide up-to-date information on instrumentation, data, and project results from ongoing science at the ARM sites. The Communications Team makes presentation materials available for ARM users attending meetings and other scientific venues. The Communications Team also engages in local outreach at each of its extended deployments (fixed sites and mobile facility deployments). The mission of local outreach is to raise the level of awareness in the local community of ARM and its purpose for deploying in a particular area. Requests for informational site visits may be made directly to the Site Manager using the Site Access Request Form.

11.0 References

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