U.S. DEPARTMENT OF ENERGY | Office of Science

DOE/SC-ARM-TR-321

ARM FY2026 Radar Plan

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September 2025

ARM

DISCLAIMER

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How to cite this document:

Theisen, A, A Matthews, M Rocque, Y-C Feng, I Lindenmaier, T Wendler, S Collis, D Wang, R Jackson, J O'Brien, B Raut, I Silber, S Gupta, M Deng, D Zhang, J Tian, N Hickmon, J Comstock, and J Mather. ARM FY2026 Radar Plan. U.S. Department of Energy, Atmospheric Radiation Measurement user facility, Richland, Washington. DOE/SC-ARM-TR-321.

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

Acronyms and Abbreviations

AI	artificial intelligence
AMF	ARM Mobile Facility
ARM	Atmospheric Radiation Measurement
ARSCL	Active Remote Sensing of Clouds Value-Added Product
ASR	Atmospheric System Research
BNF	Bankhead National Forest
CAPE-k	kennaook/Cape Grim
CMAC	Corrected Moments in Antenna Coordinates Value-Added Product
CoCoMET	Community Cloud Model Evaluation Toolkit
CoURAGE	Coast-Urban-Rural Atmospheric Gradient Experiment
CRG	CoURAGE site code
CSAPR	C-Band Scanning ARM Precipitation Radar
DOE	U.S. Department of Energy
DQ	data quality
DUSTIEAIM	Desert-Urban System Integrated Atmospheric Monsoon
EIKA	Extended-Interaction Klystron Amplifier
ENA	Eastern North Atlantic
EPC	EPCAPE site code
EPCAPE	Eastern Pacific Cloud Aerosol Precipitation Experiment
FTE	full-time equivalent
FY	fiscal year
GUC	SAIL site code
HOU	TRACER site code
HSRL	high-spectral-resolution lidar
KaSACR	Ka-Band Scanning ARM Cloud Radar
KAZR	Ka-Band ARM Zenith Radar
KAZRARSCL	Active Remote Sensing of Clouds Using Ka-Band ARM Zenith Radars Value-Added Product
KCG	kennaook/Cape Grim site code
LDIS	Laser Disdrometer Quantities Value-Added Product
LDR	linear depolarization ratio
MICROBASE	Continuous Baseline Microphysical Retrieval Value-Added Product
ML	machine learning
MWACR	Marine W-Band ARM Cloud Radar
NSA	North Slope of Alaska

OGRE-CLOUDS	Operational Ground-Based Retrieval Evaluation for Clouds
PI	principle investigator
QA	quality assurance
QC	quality control
RadCLss	Extracted Radar Columns and In Situ Sensors Value-Added Product
RF	radio frequency
SACR2	Scanning ARM Cloud Radar (second generation)
SACRGRID	Scanning ARM Cloud Radar Grid Value-Added Product
SAIL	Surface Atmosphere Integrated Field Laboratory
SGP	Southern Great Plains
SQUIRE	Surface Quantitative Precipitation Estimation Value-Added Product
TRACER	Tracking Aerosol Convection Interactions Experiment
VAP	value-added product
VDISQUANTS	Video Disdrometer Value-Added Product
WSACR	W-Band Scanning ARM Cloud Radar
XSAPR	X-Band Scanning ARM Precipitation Radar

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1.0 Introduction

The U.S. Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) User Facility maintains a suite of advanced atmospheric radar systems that serve as critical tools in ARM's mission to provide continuous, high-quality observations for advancing the understanding and modeling of atmospheric processes. These radar systems enable detailed characterization of clouds, precipitation, and dynamic structures in the atmosphere, supporting a broad range of scientific applications.

The number of deployed systems exceeds what current staffing levels can fully support for continuous 24/7/365 operation. As such, it is essential to have a clearly defined and community-informed plan that prioritizes radar operations and communicates ARM's strategy for sustaining and evolving these observational assets.

This FY2026 Radar Plan outlines ARM's approach to managing its radar portfolio—balancing scientific impact, operational feasibility, and long-term sustainability. It reflects ARM's continued commitment to delivering calibrated, well-documented radar data products that enable process-level studies and support the development and evaluation of weather and climate models. Through this plan, ARM aims to ensure transparency in decision-making, alignment with user needs, and support for innovative science across the facility's fixed and mobile observatories.

Given uncertainties around the Fiscal Year (FY) 2026 budget, this plan was developed to assume business as usual and will be updated as budgets and plans may change. It should be noted that, given the limited timeframe involved, this plan will be more succinct than previous plans.

2.0 ARM Radar Capabilities

ARM operates a diverse suite of radar systems across its fixed and mobile facilities. An inventory of current radar systems, their operating frequencies, and deployment locations is provided in Table 1. The inventory includes first-generation radars (procured circa 2010) as well as second-generation radars, which generally feature improved specifications (indicated with gray shading).

To ensure the highest scientific value for the community, ARM routinely evaluates its instrumentation. This process may lead to retirement of instruments that are either no longer scientifically impactful or that ARM is unable to efficiently operate to produce high-quality data. In recent years, ARM has retired several radar systems, including:

- **Southern Great Plains (SGP)**: X-Band Scanning ARM Precipitation Radar (XSAPR, I4 and I5; I6 remains), C-Band Scanning ARM Precipitation Radar (CSAPR, I7), and Ka/W-Band Scanning ARM Cloud Radar (SACR).
- **Eastern North Atlantic (ENA)**: Ka/W-SACR2 (second-generation), scheduled for removal in FY26.
- **ARM Mobile Facility (AMF)**: Marine W-Band ARM Cloud Radar (MWACR).

Table 1. Inventory of ARM's radars, wavelengths, and deployment locations. Gray shading indicates second-generation systems.

ARM Radar Inventory by Site
(Numbers note frequency in GHz)

Site	CSAPR	XSAPR	KAZR	Ka/WSACR	Ka/XSACR
SGP	–	9.35	35	–	–
NSA	–	9.35	35	–	–
ENA	–	9.5	35	35.3/94.0*	–
AMF1	5.7	–	35	–	–
AMF2	–	–	35	–	–
AMF3	5.7	–	35	–	35.3/9.71
Spares	–	–	–	35.3/94.0	2 x 35.3/9.71
	–	–	–	35.3/94.0	

* ENA Ka/WSACR to be retired in FY26.

3.0 Radar Team

The ARM radar team is a multidisciplinary group composed of engineering and data instrument mentors, site operations staff, and other experts who work collaboratively to ensure the successful deployment, operation, and data delivery of ARM's radar systems. Together, these components form an integrated team that supports the full radar life cycle – from installation and operations to the delivery of science-ready data. In total, the data and engineering teams have roughly 3.75 full-time equivalent (FTE) staff, each available to dedicate towards the priorities documented in this radar plan.

- **Engineering**: The engineering team focuses on the hardware of the radars including maintenance, troubleshooting, and preparations for upcoming deployments.
  ***Iosif Lindenmaier**, Timothy Wendler, Vagner Castro, Julia Flaherty*
- **Site Operations**: Members of the site operations teams include radar technicians and engineers that manage the day-to-day operations of the radar systems, working closely with the engineering instrument mentor team.
  Todd Houchens (NSA, AMFs), Brandon Androes (SGP, AMFs), David Breedlove (SGP), and Clayton Frawley (AMF3)
- **Data**: The data instrument mentor team is responsible for monitoring data quality, properly documenting any impacts to the data, and producing calibrated b-level data products from ARM's operational radars.
  Ya-Chien Feng, Marqi Rocque, Alyssa Matthews, Min Deng

- **Ingest Development**: Working closely with the data mentor team, the ingest developer applies new functions to the ingest and processes the data to b-level.
  Eddie Schuman, Brian Ermold, Erol Cromwell

Additional groups actively contribute to the success of ARM's radar data sets. These include:

- **Translator**: The translator teams (cloud and precipitation) produce value-added products (VAPs) and tools to broaden the use of ARM's radar data.
  ***TBD**, Meng Wang, Karen Johnson, Aifang Zhou, Lynn Ma, Damao Zhang, **Scott Collis**, Robert Jackson, Zachary Sherman, Joseph O'Brien, Bhupendra Raut*
- **Data Analysts**: Data analysts focus on processing, evaluating, and documenting radar datastreams to advance the usability of the data by ARM users.
  Siddhant Gupta, Jingjing Tian, Israel Silber

4.0 FY25 Summary

Fiscal Year 2025 marked an active period for ARM's radar program, with progress in operations, data quality, and product development. The radar team maintained operations at fixed and mobile sites, supported new site deployments, advanced retrieval algorithms and value-added products, and conducted key calibration activities to ensure high-quality radar data. Table 2 summarizes FY25 priorities.

Table 2. Summary of FY25 radar plan activities.

Activity	Radar	Summary of Activities	b1-Level Data Available Date or Completion Date
C0URAGE (CRG)	KAZR	• Operated with minimal disruptions. • Relatively stable. • Sidelobe filter (MD mode) updated January 28-31, 2025, to reduce sidelobe leaking impacting lower-level clouds.	March 2026
EPCAPE (EPC)	KAZR	• Final quality-controlled (QC) b-level data set released.	July 2025
	Ka/WSACR	• Final quality-controlled (QC) b-level data set released.	July 2025
CAPE-k (KCG)	KAZR	• Prior to May 2, 2024, normal operations except for LDR fluctuations (~5 dB/10 min). • May 2-June 15, 2024: RF unit replaced, and mentor visit resolved LDR fluctuations. KAZR stable since. • Side-lobe filter update in MD mode in mid-May 2025 to reduce near-surface side-lobe clutter.	Year 1: August 2025 Remaining Data: January 2026
	MWACR	• Transmitter failed July 31, 2025 and was offline for the rest of the campaign. • April 2024 to January 15, 2025: striping artifact in the background noise that had minimal effect on the cloud signatures.	Year 1: August 2025 Remaining Data: January 2026

Activity	Radar	Summary of Activities	b1-Level Data Available Date or Completion Date
		• **ARM is retiring the MWACR from operations.**	
AMF3 (BNF)	KAZR	• Operating since 11/8/2024. • Routine power outages impacted some data availability across all systems. • Initial data processing for all radars will focus on data from the operational start date defined through June 2025.	November 2025
	Ka/XSACR	• Operations since April 1, 2025. • Intermittent summer outages.	November 2025
	CSAPR	• Operations since April 1, 2025. • Pedestal gear failure June to September 2025. • Preliminary b1 analysis complete.	November 2025
ENA	KAZR	• Stable operations. • b-level data was processed for 2020-2024.	September 2025
	Ka/WSACR	• Not operated in FY25. • **ARM has decided to retire the system and remove it from ENA.**	NA
	XSAPR	• Repair attempt failed. • Planned b-level processing cancelled.	NA
NSA	KAZR	• Stable operations. • New antenna installed August 2025. • b-level data was processed for 2020-2024.	September 2025
	Ka/WSACR	• **Not reinstalled as planned.** • Plans for installation are to be determined.	NA
	XSAPR	• Operations stable and extended through summer 2025. • Transmitter has been aging leading to more restarts and limited outages. • b-level analysis is ongoing.	December 2025

SGP	KAZR	• Stable for most of FY25.
		• Major repairs in summer of FY25.
		  ○ Power dropped starting June 2025.
		  ○ TWTA replacement July 28, 2025.
		• b-level data was processed for 2020-2024.
			September 2025

	XSAPR	• **ARM is in the process of remediating the I4 and I5 XSAPR sites.**	NA

Activity	Radar	Summary of Activities	b1-Level Data Available Date or Completion Date
		• Initial planning for October visit to bring I6 online.	
Other Activities	New CSAPR2 procurement	• Mentor training with vendor. • Delivery expected September 2025. • Installation for DUSTIEAIM early 2026.	April 15, 2026
	Radar operational monitoring matrix and data quality	• Hardware and data quality (DQ) parameters set. • Preliminary metrics defined. • Summary report in progress.	September 2025
	Adaptive scanning development	• Prototype development has begun according to initial designs. • Necessary access requests and system assignments have begun.	June 2026
Cloud Radar VAPs	ARSCL	• c0-level data available through May 2025 (SGP, NSA, ENA, CRG, KCG, BNF). • July to Sep data processed soon. • c1 data (calibrated) available for SAIL (GUC).	May 2025
	MICROBASE	• Data for SGP released.	May 2025
	SACRGRID	• Released for TRACER (HOU). • BNF data processed every 3 months (current).	September 2025
	THERMOCLDPHASE	• Processed until July 1, 2024. • Covers 6 mid-/high-latitude AMF sites.	-
Precipitation Radar VAPs	CMAC (BNF)	• Processed until June 24, 2025. • Release March-June 2025 as evaluation.	September 2025
	CMAC (TRACER)	• Processed and released.	December 2024
	SQUIRE (BNF)	• Processed until June 24, 2024. • Release March - June 2025 as evaluation.	September 2025
	RadCLss (BNF)	• Processed until June 24, 2025. • Release March-June 2025 as evaluation.	September 2025
	CMAC (NSA XSAPR)	• Sea ice filter under evaluation. • 2023 data processed for evaluation.	September 2025
	RadCLss (NSA)	• Initial investigations underway.	September 2025
	SAIL VAPS	• SQUIRE, CMAC, and RadCLss released.	July 2025

Activity	Radar	Summary of Activities	b1-Level Data Available Date or Completion Date
Radar Data Analysis	Data epochs on mesoscale cellular organizations	• ENA cases shared as epochs. • CAPE-k ongoing. • Preliminary results under evaluation through February 2025.	July 2025 (ENA)
	Cell tracking	• Community feedback gathered (ARM/ASR breakout). • Existing software reviewed (CoCoMET). • Framework design review upcoming.	June 2026
	Sub-cloud ice precipitation retrievals	• On hold while investigating HSRL data. • Timeline TBD.	TBD
	KAZR spectra	• Deferred to FY26 due to other priorities.	September 2026

5.0 FY26 Plan

The FY2026 radar priorities are guided by a combination of scientific demand, operational realities, and long-term strategic planning. These efforts aim to maximize the scientific return of ARM's radar assets while ensuring sustainable operations. Key areas of focus include continued support of the KAZR as a vital cornerstone of ARM's radar capabilities, support for mobile facility deployments, and advancing ARM's radar data products. A list of the priorities, timelines, effort allocations, and points of contact can be found in following tables. The full FY26 Gantt chart is in Appendix 1.

5.1 Radar Operations

Radar operations encompass a range of coordinated tasks across the engineering, data, site operations, and ingest teams. To provide clarity, the following categories are used in the subsequent tables:

- **Radar Operations**
  Engineering and site operations tasks required to keep radars running, including maintenance, troubleshooting, and system repairs.
- **Data Quality Monitoring**
  Continuous monitoring of radar data by the data mentor team, addressing quality issues, and assessing how engineering work impacts the data.
- **b1-Analysis**
  Mentor team analysis to identify offsets and corrections. Deliverables include a technical report documenting methods, results, and recommendations, released alongside the data.
- **Ingest Dev and Proc**
  Configuration of data ingest systems and application of corrections. Processed data are then returned to the mentor team for review.

5.1.1 KAZR Operations

In FY26, ARM's Ka-Band ARM Zenith Radars (KAZRs) will continue their role as the primary vertically pointing cloud radars across ARM observatories. Operations will emphasize maintaining high data availability through routine monitoring, preventative maintenance, and calibration activities.

A key highlight is the creation of b-level data products for the fixed sites in late FY25 to early FY26, marking the start of routine b1-level data creation at the fixed sites on a yearly basis. This is anticipated to be released routinely in the spring but may be adjusted based on AMF deployments. For the mobile facilities, b-level KAZR data will be made available within six months of the completion of the deployment. AMF3 KAZR data will be released in early FY26 with the next round anticipated at the end of FY26. See the following tables for further information on KAZR activities.

5.1.2 ARM Mobile Facilities

5.1.2.1 AMF1, AMF2

CoURAGE (AMF1) will end November 30, 2025, with the operation of the KAZR being relatively stable. b-level data will be made available by March 2026 (Table 3).

DUSTIEAIM (AMF1) is scheduled to begin April 15, 2026, with the deployment of a KAZR and the newest CSAPR2, currently in production (Table 3). These radars will operate through FY27 with b-level data made available in FY27 for the first year and the remaining data in FY28, dependent on other priorities.

CAPE-k (AMF2) will end October 15, 2025 (Table 3). As noted in the FY25 summary, the MWACR failed July 31, 2025, and was not brought back online. The KAZR is anticipated to continue operating through the end of the deployment. The first year of data was processed to a b-level in late FY25 and the remaining six months of data are anticipated to be processed and available by January 2026.

The next deployment for AMF2 has not been selected so the timelines for deployment are unknown. We anticipate that some effort will be necessary in FY26 to prepare radar systems for deployment. Once the timelines are known, the schedule and effort will be updated.

Table 3. FY26 Gantt chart of AMF1 and AMF2 radar activities.

	October 2025	November 2025	December 2025	January 2026	February 2026	March 2026	April 2026	May 2026	June 2026	July 2026	August 2026	September 2026	Engineering FTE	Data FTE	Other FTE	Priority	Lead
CoURAGE (AMF1)																	
KAZR																	
Radar Operations													0.02			1	Wendler
Data Quality Monitoring														0.01		1	Deng
b1 Analysis														0.15		1	Deng
Ingest Dev and Proc														0.03		1	Schuman
CAPE-k (AMF2)																	
KAZR																	
Radar Operations													0.01			1	Wendler
Data Quality Monitoring														0.01		1	Deng
b1 Analysis														0.10		1	Matthews
Ingest Dev and Proc														0.03		1	Schuman
MWACR																	
Radar Operations																1	Wendler
Data Quality Monitoring																1	Matthews
b1 Analysis														0.10		1	Matthews
Ingest Dev and Proc														0.03		1	Schuman
DUSTIEAIM (AMF1)																1	
Preparations													0.08			1	Lindenmaier
Installation													0.12			1	Lindenmaier
KAZR																	
Radar Operations													0.07			1	Wendler
Data Quality Monitoring														0.04		1	Deng
CSAPR2																	
Radar Operations													0.16			1	Lindenmaier
Data Quality Monitoring														0.12		1	Rocque/Matthews
TBD (AMF2) - Unknown																	
Preparations													0.63	0.05		1	Lindenmaier

5.1.2.2 AMF3: BNF

At Bankhead National Forest (AMF3, BNF), FY26 activities will prioritize operations of the CSAPR2, Ka/X-SACR, and KAZR (Table 4). **The first set of calibrated b-level data is anticipated to be available by the end of November 2025**. For the scanning radars, this will be for data from April 2025 through June 2025. Analysis for the next batch of data will begin in June 2026 with expected availability in October 2026.

The XSACR transmitter output power is steadily declining and will be replaced in the fall of FY2025 or spring of 2026. The calibration tower for the KASACR was installed in early September 2025. A new Extended-Interaction Klystron Amplifier (EIKA) will be installed in early spring, 2026.

Table 4. FY26 Gantt chart of AMF3 radar activities.

	October 2025	November 2025	December 2025	January 2026	February 2026	March 2026	April 2026	May 2026	June 2026	July 2026	August 2026	September 2026	Engineering FTE	Data FTE	Other FTE	Priority	Lead
BNF (AMF3)																	
KAZR																	
Radar Operations	■	■	■	■	■	■	■	■	■	■	■	■	0.10			1	Wendler
Data Quality Monitoring	■	■	■	■	■	■	■	■	■	■	■	■		0.08		1	Deng
b1 Analysis	■	■							■	■	■			0.15		1	Deng
Ingest Dev and Proc	■	■									■	■		0.03		1	Schuman
Ka/XSACR																	
Radar Operations	■	■	■	■	■	■	■	■	■	■	■	■	0.62			1	Wendler
Planned Maintenance	■					■							0.02			1	Wendler
Data Quality Monitoring	■	■	■	■	■	■	■	■	■	■	■	■		0.22		1	Matthews
b1 Analysis	■	■							■	■	■			0.50		1	Matthews
Ingest Dev and Proc	■	■									■	■		0.06		1	Schuman
CSAPR2																	
Radar Operations	■	■	■	■	■	■	■	■	■	■	■	■	0.32			1	Lindenmaier
Data Quality Monitoring	■	■	■	■	■	■	■	■	■	■	■	■		0.10		1	Rocque
b1 Analysis	■	■							■	■	■			0.20		1	Rocque
Ingest Dev and Proc	■	■									■	■		0.03		1	Schuman

5.1.3 Fixed Observatories

5.1.3.1 Southern Great Plains (SGP)

In addition to the KAZR noted above, ARM plans to bring the I6 XSAPR back online in **October 2025 and operate through the 2026 spring convective season** (Table 5). Processed b-level data are expected to be available in October 2026. Additionally, in order to set up the b-level process for this radar for the first time, some historical data may be analyzed and processed to prepare.

5.1.3.2 North Slope of Alaska

ARM will continue to operate the NSA XSAPR as it can through the winter and into the summer (Table 5). However, if the XSAPR experiences a failure over the winter, repairs may not be attempted until the following summer. The development of processes for the NSA XSAPR has been delayed due to a lack of summertime data and QA/QCed disdrometer data. We anticipate that the first batch of processed b-level data will be available by the end of December 2025.

ARM has not determined when or if the newly upgraded SACR2 will be deployed again at NSA. Once that determination is made, the radar plan will be updated.

5.1.3.3 Eastern North Atlantic

If effort is available, a secondary FY26 activity will be to bring the ENA XSAPR back online. Remote testing would begin in the fall of 2025 with a goal to get the system operational for the spring 2026 (Table 5). Data product development would occur in FY27.

As noted earlier, the SACR2 was retired in FY25. Effort will be needed by the mentor and site operations to pack and remove the SACR from the site in FY26.

Table 5. FY26 Gantt chart of fixed observatory radar activities.

	October 2025	November 2025	December 2025	January 2026	February 2026	March 2026	April 2026	May 2026	June 2026	July 2026	August 2026	September 2026	Engineering FTE	Data FTE	Other FTE	Priority	Lead
SGP																	
KAZR																	
Radar Operations													0.10			1	Wendler
Data Quality Monitoring														0.04		1	Rocque
b1 Analysis														0.10		1	Rocque
Ingest Dev and Proc														0.03		1	Schuman
XSAPR Operations																	
Calibration Trip													0.02			1	Lindenmaier
Radar Operations													0.24			1	Lindenmaier
Data Quality Monitoring														0.08		1	Feng
b1 Analysis														0.23		1	Feng
Ingest Dev and Proc														0		1	Schuman
NSA																	
KAZR																	
Radar Operations													0.14			1	Wendler
Data Quality Monitoring														0.04		1	Rocque
b1 Analysis														0.10		1	Rocque
Ingest Dev and Proc														0.03		1	Schuman
SACR																	
Installation													0.10			2	Lindenmaier
XSAPR																	
Radar Operations													0.32			2	Lindenmaier
Data Quality Monitoring														0.11		2	Rocque
b1 Analysis														0.19		2	Rocque
Ingest Dev and Proc														0.03		2	Schuman
ENA																	
KAZR Operations																	
Radar Operations													0.10			1	Lindenmaier
Data Quality Monitoring														0.04		1	Rocque
b1 Analysis														0.10		1	Rocque
Ingest Dev and Proc														0.03		1	Schuman
XSAPR Operations																	
Repairs and Testing													0.05			2	Lindenmaier
Radar Operations													0.13			2	Lindenmaier
Data Quality Monitoring														0.05		2	Feng

5.2 Other Radar Activities

5.2.1 SACR Upgrade to Solid State

The EIKA used in the SACRs are no longer in production. ARM has invested in procuring three Ka and one W EIKAs in FY25. These, along with available supplies of EIKAs in ARM, will be exhausted in the next 5-10 years. ARM is exploring the possibility of upgrading the SACRs to solid-state power amplifiers.

5.2.2 SACR2 Testing

The NSA SACR2 is expected to be available for further testing to determine if more improvements could be made for other SACR systems. The engineering team, as time permits, will perform additional testing for cooling and drying, with the data team providing support for data analysis.

5.2.3 Handbook Update

Radar handbooks have not been updated in over 10 years. The mentor team worked to update the KAZR and SACR handbooks in FY25 and will continue to update handbooks, as time permits, in FY26.

5.2.4 Data Processing Publication

The data mentor team has spent a lot of time developing processes for creating b-level radar data products that are calibrated and QCed. The specifics of this processing are detailed in the b-level reports provided with each set of data. These reports also take significant effort to produce. It will be a priority to publish an article documenting ARM's standard b-level processing in order to streamline these reports and provide a citable reference for ARM's processing efforts.

5.2.5 Define Baseline Scan Strategies

ARM generally has relied on principle investigators (PIs) to define scan strategies to maximize the impact of the data to their deployments. However, it will be beneficial for ARM to define baseline scan strategies for both fixed and mobile observatories for which PIs could request modifications to for ARM approval as part of a field campaign request. This is to ensure that the mentor team is involved in any conversations around changes to scan strategies to ensure that the appropriate data are collected to support the b-level processing.

5.2.6 Adaptive Scanning Development

ARM will continue to develop adaptive scanning capabilities, starting with the CSAPR2 at BNF. This system will implement a middleware layer for users to engage with to pass along instructions to the CSAPR2 and eventually include plug-ins for additional radar and lidar systems. We anticipate that this capability would be available to PIs towards the end of FY26.

5.2.7 Cell Tracking Development

In parallel to develop adaptive scanning capabilities, ARM is developing a framework for post-analysis and real-time cell-tracking capabilities that is planned to supply input to the adaptive scanning software. Initial testing is expected to occur on the BNF CSAPR2 in the summer of FY26.

Table 6. FY26 Gantt chart of other radar activities.

	October 2025	November 2025	December 2025	January 2026	February 2026	March 2026	April 2026	May 2026	June 2026	July 2026	August 2026	September 2026	Engineering FTE	Data FTE	Other FTE	Priority	Lead
SACR Upgrade to Solid State													0.15			2	Wendler
SACR2 Testing (PNNL)													0.10	0.05		2	Lindenmaier
Handbook Updates													0.10	0.10		1	Wendler
b1-level Processing Paper														0.20		1	Feng
Scan Strategy Development														0.05		2	Feng
Adaptive Scanning Development															0.10	1	Schuman
Cell Tracking Development															0.20	1	Gupta
Other													0.20	0.20		1	

5.3 Future Priorities

As ARM continues to support cutting-edge atmospheric research, the radar program remains focused on advancing its capabilities to meet evolving scientific and operational needs. Known projects that ARM will undertake in the upcoming fiscal years, in addition to supporting operations at ARM observatories, include:

- Development of a new W-band vertically pointing radar to replace the retired MWACR
- Upgrade remaining SACRs in ARM to new coolers and dryers
- Streamlining data quality monitoring and data processing, blending AI/ML methods with expert oversight from the mentors
- Improving integration between operations, data and product development. Minimizing duplication.
- In conjunction with ARM's AI/ML plan, explore autonomous operations to improve mode switching (KAZR) or scanning.

5.4 Value-Added Products and Data Analysis

5.4.1 Cloud Radar

Staffing: TBD, Meng Wang, Karen Johnson, Aifang Zhou, Lynn Ma, Damao Zhang

5.4.1.1 ARSCL

In FY26, the goal is to ensure that c0-level data are available within two to three months after KAZR data collection at each site (including new campaigns and fixed sites). We will continue to prioritize the release of the data for the BNF site. Additionally, calibrated ARSCL c1-level data will be processed for all past campaigns (e.g., EPC, KCG) and upcoming ones if radar data are calibrated. The conversion of CLOUDRADARCOR codes into Python is finalized in FY25 and in FY26, our goal is to release the Python version of the entire ARSCL processing codes. New activities will also include providing ground-based validation for EarthCare overpasses at the ARM fixed sites.

5.4.1.2 MICROBASE

This VAP requires inputs from several other VAPs, such as microwave radiometer and ARSCL c1-level data. Its release for the GUC and EPC sites are expected to be completed in FY26, with the possibility of releasing data for KCG, and BNF if all inputs are available. This VAP also serves as an input to the Operational Ground-Based Retrieval Evaluation for Clouds (OGRE-CLOUDS) framework that is expected to be released in Github in Sept. 2025.

5.4.1.3 SACRGRID

This VAP will be processed for SACR locations if raw data are available.

5.4.1.4 THERMOCLDPHASE

THERMOCLDPHASE at NSA will continue to be processed using available Active Remote Sensing of Clouds Using Ka-Band ARM Zenith Radars Value-Added Product (KAZRARSCL) data and will also be processed for the CAPE-k and ENA sites.

5.4.2 Precipitation Radar

Staffing: Scott Collis, Robert Jackson, Zach Sherman, Joe O'Brien, Bhupendra Raut

5.4.2.1 Corrected Moments in Antenna Coordinates (CMAC)

CMAC is ARM's value-added product that enhances precipitation radar data in native range, azimuth, and elevation coordinates. Where needed, it builds on the b-level products by: dealiasing, attenuation correcting, providing additional clutter IDing, and retrieving rain rate or snowfall rate using the regionally appropriate relations.

During FY26 we will:

- Operationalize CMAC at Bankhead National Forest
- Continue to monitor the performance of the retrievals at BNF
- Implement FY25 work on sea ice detection at NSA
- Use in situ measurements at E12 and C1 at NSA to determine snowfall and rainfall rate relations

- Perform initial CMAC (non-operational) on NSA XSAPR.

5.4.2.2 Surface Quantitative Precipitation Estimation (SQUIRE)

SQUIRE (Jackson et al. 2025), which takes CMAC as an input, maps radial coordinate precipitation rates to a plane intended to represent the surface. Where the lowest elevation is compromised (blocked, clutter) data is projected from a higher tilt to the surface. Data is aggregated into daily files (lat, lon, time) for easy use by the community.

During FY26 we will:

- Operationalize SQUIRE at BNF
- Gather feedback on usage at BNF and look for improvements
- Produce initial SQUIRE products for NSA X-SAPR (non-operational).

5.4.2.3 Extracted Radar Columns and In Situ Sensors (RadCLss)

RadCLss is a product that helps users with a very common operation needed for retrieval development: Simply extracting a column of radar data over an in situ or zenith-pointing site, effectively creating a time-height series.

During FY26 we will:

- Operationalize RadCLss at BNF
- Even though the scanning strategy is not ideal, perform RadCLss at E12 at NSA
- Provide feedback on optimal radar scanning to enable better columns.

5.4.2.4 Tools

We will continue development of the Python ARM Radar Toolkit with a focus on supporting the radar mentor team and cloud products team. We will also develop xradar in collaboration with our international partners.

We will investigate how we can reboot development on Py-TMatrix as it is a key need for VAPS like Laser Disdrometer Quantities Value-Added Product (LDIS) and Video Disdrometer Value-Added Product (VDISQUANTS).

5.4.2.5 Other

During FY26 the team will work with the science community, mentors, and users to identify roadblocks to data usage. We will also promote NSA XSAPR data to the polar community in an effort to enhance the impact of this unique radar system.

5.4.3 Data Analyst

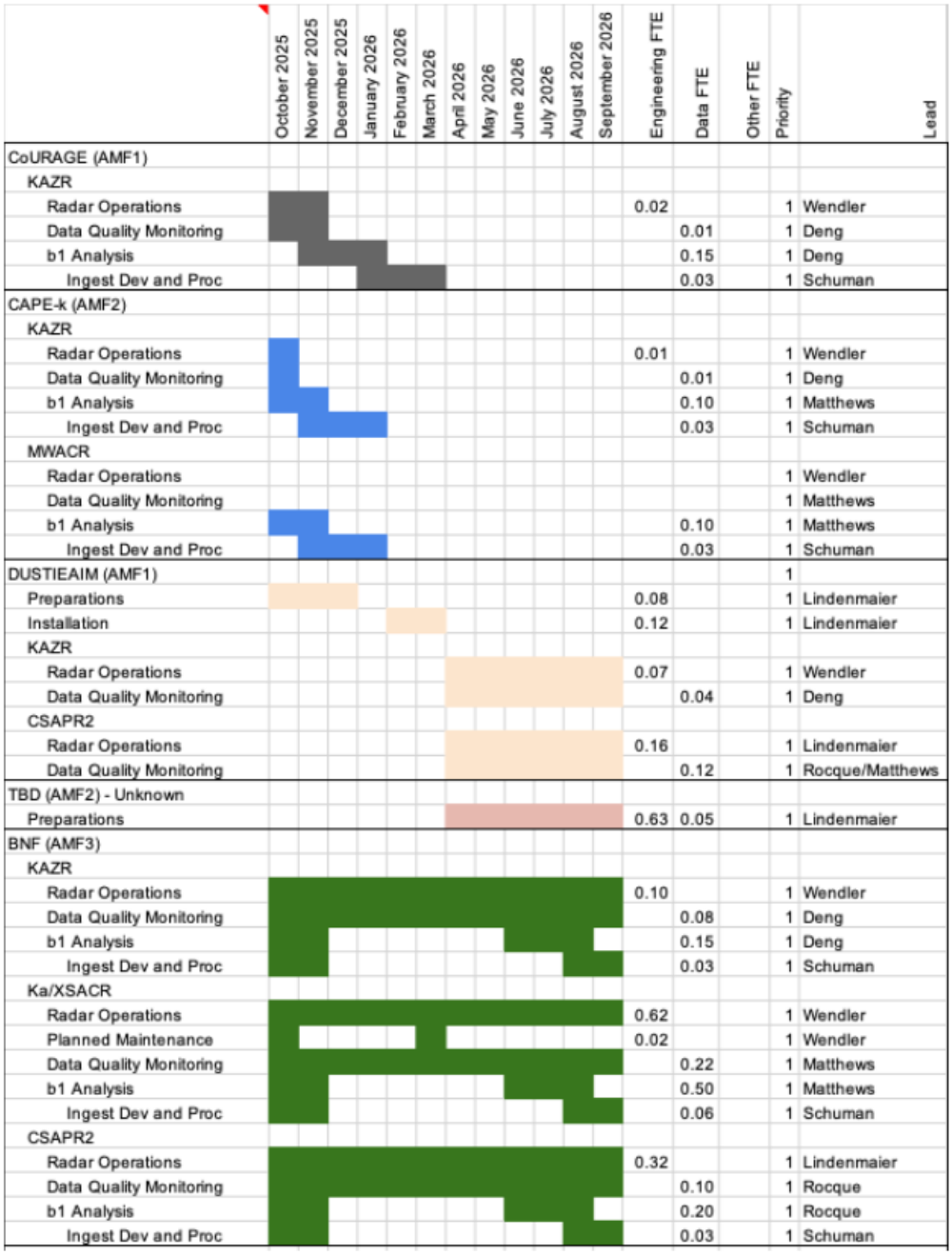
In FY26, the data analyst team will release data epochs on mesoscale cellular organizations from the Cape-k field campaign, which will end in October 2025. The analyst team will also start working (with collaborators) on the decomposition of KAZR spectra to automate the identification and characterization of hydrometeor populations and, ultimately, integrate the final decomposed spectral product in ARM ingest to leverage KAZR capabilities that hitherto were not used to their fullest potential, such as vertical velocity. The development of multi-band radar retrievals using novel AI/ML techniques will also be explored.

6.0 References

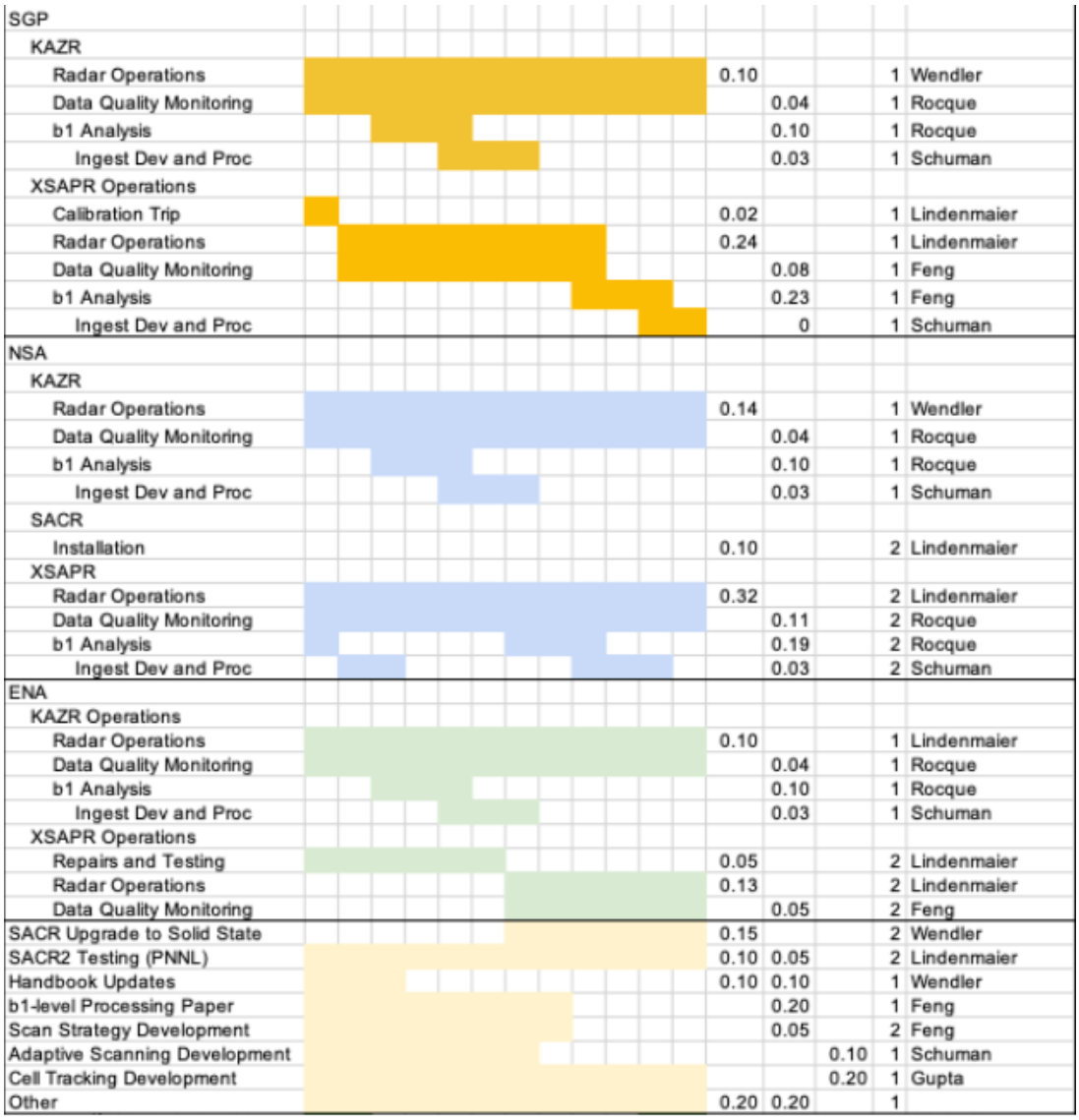
Jackson, RC, JR O'Brien, M Grover, S Sherman, S Collis, BA Raut, M Tuftedal, A Theisen, D Feldman, W Rudsill, and V Chandrasekar. 2025. Surface Quantitative Precipitation Estimates (SQUIRE) of snow water equivalent from the Surface Atmosphere Integrated Laboratory. *Journal of Atmospheric and Oceanic Technology*. Under review.

Appendix A

Full FY26 radar activities Gantt chart



	Engineering FTE	Data FTE	Other FTE	Priority	Lead
CoURAGE (AMF1)					
KAZR					
Radar Operations	0.02			1	Wendler
Data Quality Monitoring		0.01		1	Deng
b1 Analysis		0.15		1	Deng
Ingest Dev and Proc		0.03		1	Schuman
CAPE-k (AMF2)					
KAZR					
Radar Operations	0.01			1	Wendler
Data Quality Monitoring		0.01		1	Deng
b1 Analysis		0.10		1	Matthews
Ingest Dev and Proc		0.03		1	Schuman
MWACR					
Radar Operations				1	Wendler
Data Quality Monitoring				1	Matthews
b1 Analysis		0.10		1	Matthews
Ingest Dev and Proc		0.03		1	Schuman
DUSTIEAIM (AMF1)				1	
Preparations	0.08			1	Lindenmaier
Installation	0.12			1	Lindenmaier
KAZR					
Radar Operations	0.07			1	Wendler
Data Quality Monitoring		0.04		1	Deng
CSAPR2					
Radar Operations	0.16			1	Lindenmaier
Data Quality Monitoring		0.12		1	Rocque/Matthews
TBD (AMF2) - Unknown					
Preparations	0.63	0.05		1	Lindenmaier
BNF (AMF3)					
KAZR					
Radar Operations	0.10			1	Wendler
Data Quality Monitoring		0.08		1	Deng
b1 Analysis		0.15		1	Deng
Ingest Dev and Proc		0.03		1	Schuman
Ka/XSACR					
Radar Operations	0.62			1	Wendler
Planned Maintenance	0.02			1	Wendler
Data Quality Monitoring		0.22		1	Matthews
b1 Analysis		0.50		1	Matthews
Ingest Dev and Proc		0.06		1	Schuman
CSAPR2					
Radar Operations	0.32			1	Lindenmaier
Data Quality Monitoring		0.10		1	Rocque
b1 Analysis		0.20		1	Rocque
Ingest Dev and Proc		0.03		1	Schuman



SGP					
KAZR					
Radar Operations	0.10			1	Wendler
Data Quality Monitoring		0.04		1	Rocque
b1 Analysis		0.10		1	Rocque
Ingest Dev and Proc		0.03		1	Schuman
XSAPR Operations					
Calibration Trip	0.02			1	Lindenmaier
Radar Operations	0.24			1	Lindenmaier
Data Quality Monitoring		0.08		1	Feng
b1 Analysis		0.23		1	Feng
Ingest Dev and Proc		0		1	Schuman
NSA					
KAZR					
Radar Operations	0.14			1	Wendler
Data Quality Monitoring		0.04		1	Rocque
b1 Analysis		0.10		1	Rocque
Ingest Dev and Proc		0.03		1	Schuman
SACR					
Installation	0.10			2	Lindenmaier
XSAPR					
Radar Operations	0.32			2	Lindenmaier
Data Quality Monitoring		0.11		2	Rocque
b1 Analysis		0.19		2	Rocque
Ingest Dev and Proc		0.03		2	Schuman
ENA					
KAZR Operations					
Radar Operations	0.10			1	Lindenmaier
Data Quality Monitoring		0.04		1	Rocque
b1 Analysis		0.10		1	Rocque
Ingest Dev and Proc		0.03		1	Schuman
XSAPR Operations					
Repairs and Testing	0.05			2	Lindenmaier
Radar Operations	0.13			2	Lindenmaier
Data Quality Monitoring		0.05		2	Feng
SACR Upgrade to Solid State	0.15			2	Wendler
SACR2 Testing (PNNL)	0.10	0.05		2	Lindenmaier
Handbook Updates	0.10	0.10		1	Wendler
b1-level Processing Paper		0.20		1	Feng
Scan Strategy Development		0.05		2	Feng
Adaptive Scanning Development			0.10	1	Schuman
Cell Tracking Development			0.20	1	Gupta
Other	0.20	0.20		1	

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