ARM Third Mobile Facility Instrumentation Phased Deployment Plan for Southeast U.S. (BNF) Field Site

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July 2024

Acronyms and Abbreviations

ACSM-TOF	aerosol chemical speciation monitor−time of flight mass spectrometer
AERI	atmospheric emitted radiance interferometer
AMC	AmeriFlux measurement component
AMF	ARM Mobile Facility
AOSMET	Aerosol Observing System surface meteorology instrumentation
APS	aerodynamic particle sizer
ARM	Atmospheric Radiation Measurement
ASI	all-sky imager
BNF	Bankhead National Forest
BWWC	Black Warrior Work Center
CAPS	cloud aerosol and precipitation spectrometer
CAPS3W	3-wavelength cloud aerosol and precipitation spectrometer
CCN200	cloud condensation nuclei counter
CEIL	ceilometer
CO	carbon monoxide monitor
CO_2FLX	carbon dioxide flux measurement system
CPC	condensation particle counter
CPCU	condensation particle counter−ultrafine
CSAPR2	C-band Scanning ARM Precipitation Radar
CSPHOT	Cimel sun photometer
DL	Doppler lidar
DTS	distributed temperature sensing
ECOR	eddy correlation flux measurement system
GNDIRT	ground infrared thermometer
HSRL	high-spectral-resolution lidar
HTDMA	humidified tandem differential mobility analyzer
INS	ice nucleating spectrometer
IRT	infrared thermometer
KAZR	Ka-band ARM Zenith Radar
LDIS	laser disdrometer
MAWS	meteorological automatic weather station
MET	surface meteorological instrumentation
METWXT	WXT520/530 meteorological instrumentation
MFR	multifilter radiometer
MFRSR	multifilter rotating shadowband radiometer
MPL	micropulse lidar

MWR3C	microwave radiometer, three-channel
NEPHDRY	nephelometer − dry
O_3	ozone monitor
PAR	photosynthetically active radiation
PGSISO	precision gas system isotope analyzer
PSAP	particle soot absorption photometer
RADSYS	PC-based weather radar display
RL	Raman lidar
RWP	radar wind profiler
SACR	Scanning ARM Cloud Radar
SEBS	surface energy balance system
SGP	Southern Great Plains
SIRS	solar infrared radiation station
SMPS	scanning mobility particle sizer
SO_2	sulfur dioxide analyzer
SONDE	balloon-borne sounding system (4/day)
SP2	single-particle soot photometer
SP2-XR	single-particle soot photometer – extended range
STAMP	soil temperature and moisture profiles system
STEREOCAM	stereo cameras for clouds
TOWERMET	multi-level meteorological instrumentation
TBS	tethered balloon system
UHSAS	ultra-high-sensitivity aerosol spectrometer
VDIS	video disdrometer (procure new)
WBPLUVIO2	weighing bucket rain gauge (procure new)

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1.0 Introduction

The Third Atmospheric Radiation Measurement (ARM) Mobile Facility (AMF3) will be deployed in two phases. Phase 1 will include a Main Office Site, Main Instrument Site, and a 140-foot tower in the Bankhead National Forest (BNF) in north central Alabama. The planned installation is for the main site to consist of a majority of the AMF3 instrumentation to be deployed in a 300'x300' clearing immediately south of the Black Warrior Work Center (BWWC) and a tall 140-foot walk-up scaffold tower nearby deep in the forest. Phase 1 will also consist of three supplemental sites triangulated within 80 km around the main site and the second-generation C-band Scanning ARM Precipitation Radar (CSAPR2) planned to be installed to scan over the main site and tower location. One of the supplemental sites is planned to have a nearby tower located in a forested area adjacent to an agricultural field and another site to include just an agricultural site. Phase 2 will include the installation of the Ka/X-band Scanning ARM Cloud Radar (SACR), an area of operations for the tethered balloon system (TBS) adjacent to the Main Instrument Site, and the in-forest tower at the supplemental site mentioned above, as well as any additional instrumentation and tasks remaining from Phase 1.

Timeline: Phase 1: FY2024; Phase 2: FY2025.

Figure 1. Main Site at BWWC.

Figure 2. 140-ft tower location at the BWWC.

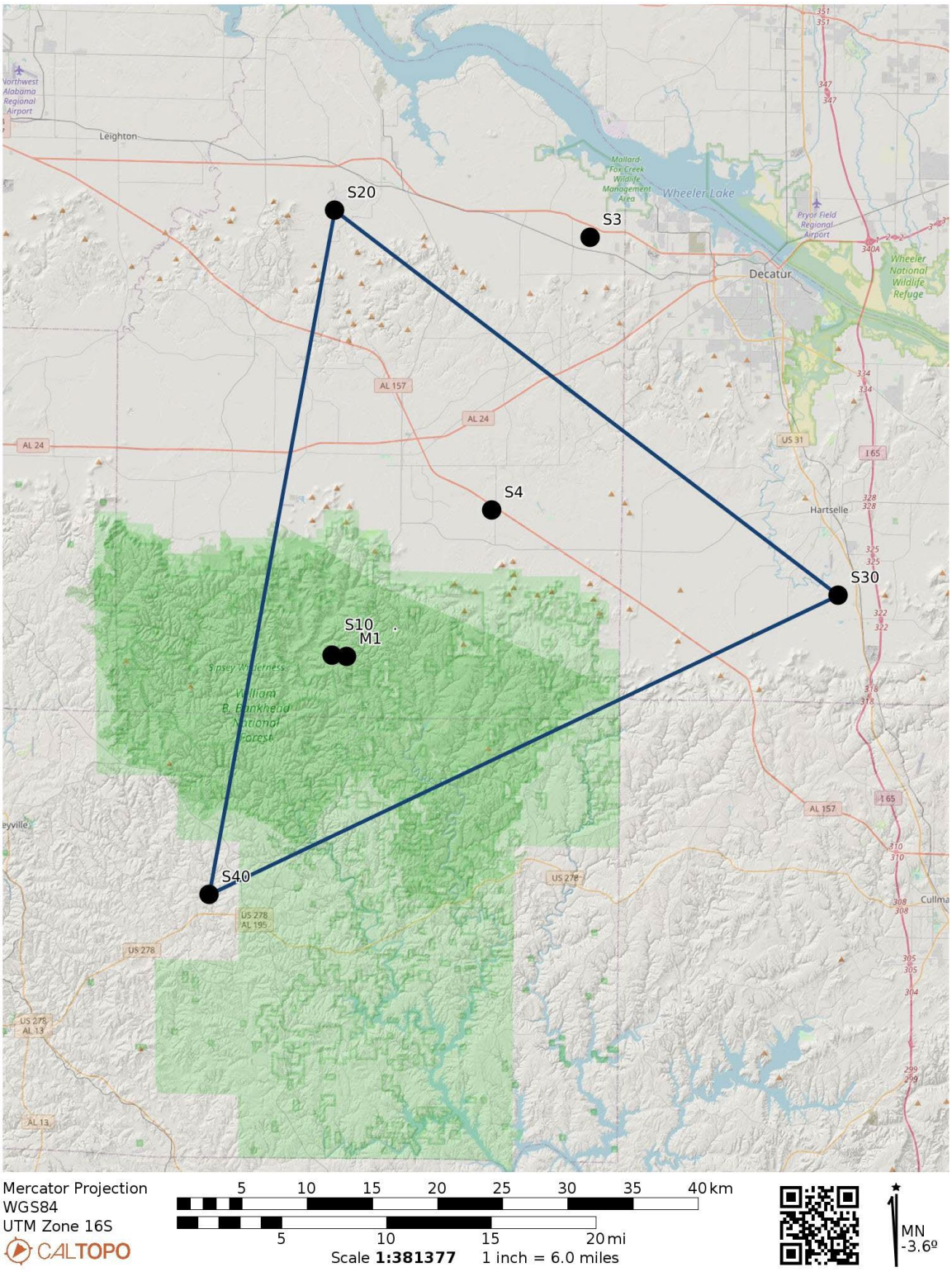

Figure 3. AMF3 deployment. Sites are as follows: Main Site: M1; 140' Tower Site: S10; CSAPR2: S3; SACR: S4; Supplemental Sites: S20, S30, and S40.

2.0 Phase 1

2.1 Main Site

As part of Phase 1, the main AMF3 site will be deployed with the following instrumentation:

Table 1. AMF3 Phase 1 instruments (BNF M1).

AERI	KAZR	RWP
Cameras	LDIS	SIRS
CEIL	MAWS	SONDE (4/day)
CSPHOT	MET	ASI
DL	MFRSR	VDIS
HSRL	MPL	WBPLUVIO2
INS	MWR3C	
IRT	RL	

Table 2. AMF3 Phase 1 aerosol instruments (BNF M1).

ACSM-TOF	CPCU	SMPS
AOSMET	HTDMA	SO_2
APS	IMPACTOR	SP2-XR
CAPS3W	INS	UHSAS
CCN200	NEPHDRY	
CO	O_3	
CPCF	PSAP	

Main Site instruments in review or approved for field campaigns – Phase 2: stereo cameras (one at tower and one at main site), NO_x monitor.

2.2 Tower Site

The tower site will comprise a 140-ft walk-up tower approximately 1200m west of the main site. The following instruments will be deployed in Phase 1.

Table 3. AMF3 Tower Phase 1 instruments (BNF).

	SURFACE	4M	10M	BELOW CANOPY	MID CANOPY	ABOVE CANOPY	TOP
AmeriFlux CO_2 Flux System				X		X	X
AmeriFlux Storage System*			X	X	X	X	X
ASI							X
CAMERA**		X (2)					X(1 PTZ)
CEIL***	X						X
CPC****			X	X		X	X
DTS (2025)	X	X	X	X	X	X	X
GNDIRT		X (2)			X (3)		X (3)
LDIS							X
MFR			X			X	
PGSISO			X	X		X	X
PAR		UP/DOWN	DOWN	DOWN			UP/DOWN
RADSYS	UP/DOWN					UP/DOWN	
SEBS	X						
STAMP	X						
TOWERMET (T/RH/U/V/W)			X	X		X	X
TOWERMET (Pres/Precip)	X						

Note: Up/Down refer to upwelling and downwelling radiation
* 8 levels to be fully defined at a later date and dependent on canopy structure
**Camera may be at the same height as the IR Radiometer but is dependent on surface conditions
***CEIL location dependent upon final configuration. There will be only 1 CEIL at the tower
****First CPC will be deployed at the top of the tower but is subject to change.

2.3 Two Tower Supplemental Sites

Table 4. Tower Supplemental Site (at surface ~40m away from tower) instrumentation.

Instrument	Site 1	Site 2
STAMP	X	X
ECOR	X	X
SEBS	X	X
GNDIRT	X	X
METWXT	X	X
PAR (2 upwelling, 1 downwelling)	X	X

2.4 HTDMA

The HTDMA has been approved for operations at BNF. ARM only operates two HTDMA systems and to balance the needs of ARM and other mobile facility deployments, HTDMA operations are expected to be episodic. Details of the planned HTDMA operations will be made available prior to the start of the upcoming fiscal year through the Aerosol Operations Plan.

2.5 Radar Site

Two locations have been identified and licensed for operations. The base expectation is that one location (near Trinity, Alabama) will house the CSAPR2 and the second location, closer to the main site (near Moulton, Alabama), will house the Ka/X-SACR (see section 3.1).

- CSAPR2

2.6 Three Supplemental sites: (~80km away from Main Site) Approved

Phase 1 will focus on the installation of three supplemental sites. There will be two supplemental profiling facilities with the possibility to add additional instrumentation to a partner site. The supplemental site instrumentation would include:

Table 4. Supplemental Sites triangulated around BNF.

Instrument	Site 1(S20)	Site 2(S40)	Site 3(S30)
AERI	X	X	
DL	X	X	
MWR3C	X	X	
ECOR	X	X	X
IRT	X	X	X
LDIS			X
MET	X	X	X
MFRSR	X	X	X
SIRS	X	X	X
SEBS	X	X	X
STAMP	X	X	X
RWP			X

3.0 Phase 2 (FY2025)

Any remaining tasks from Phase 1 will be handled in Phase 2. Additional instruments will be deployed as necessary, which may or may not include additions to the suites of instruments at the main and supplemental sites, additions to or reconfigurations of the tower measurements, and/or deployment of additional supplemental sites to support stereo cameras for clouds (STEREOCAM) or sky imaging measurements.

3.1 Radar Site

The Ka/X-SACR site location has been leased and the construction will commence likely at the very end of FY2024 and continue on into FY2025 with operational scans commencing in FY2025.

3.2 TBS Site

An additional area of operations for the TBS facility will be cleared and prepared south of the Main Instrument Field at M1. TBS operations are expected to start in the spring of 2025.

3.3 Supplemental Sites Tip Tower in Forest (1): Under Review

Table 6, Supplemental Forest tower.

Instrument	Site 1
Camera	X
IRTGROUND	X
PAR	X
SEBS**	X
ECOR**	X
STAMP	X

*Requested but not approved.
**ECOR/SEBS will be determined based on science and siting requirements.

3.4 Supplemental Sites Aerosol Nodes (2 Sites): Accepted

Note: Measurements list is an example of possible measurements. Final corresponding instrument list is in design.

Table 7. Proposed measurements for the new Aerosol Nodes.

Measurement	Site 1(S20)	Site 2(S40)
Dry particle size distribution	X	X
Total number concentration	X	X
Cloud condensation nuclei activity*	X	X
Ice nucleating particle activity*	X	X
Black carbon*	X	X
Trace gases*	X	X

*Under discussion for potential deployment at a future date.