



# Connecting DOE SBIR Awardees with ARM and ASR to Enhance Atmospheric Research

ADAM THEISEN, GAVIN MCMEEKING, TIM ONASCH



# Agenda



Time (ET)	Description	Presenter (s)
10:45-11:15	Overview of the ARM User Facility Capabilities and Q&A	Adam Theisen, Nicki Hickmon
	<b>Lightning Talks</b>	
11:15-11:20	Coupled Aerodynamic and Optical Sizing for Coarse Particles	Stavros Amanatidis
11:20-11:25	Adaptive Measurement of Nuclei Particle Size and Concentration	Stavros Amanatidis
11:25-11:30	Measurement of atmospheric sulfuric acid concentration using a water-based condensation particle counter	Arantzazu Eiguren
11:30-11:35	Instantaneous Aerosol Mobility Sizing	Steven Spielman
11:35-11:40	Low-Cost Aerosol Size Distribution and Light Absorption Instruments for Urban Monitoring Applications	Fredrick Brechtel
11:40-11:45	A Low-Cost Holographic Sensor for Urban Aerosol Characterization	Matthew Freer
11:45-11:50	A low-cost, networkable fluorescence spectrometer for automatic identification of pollen and other coarse mode aerosols found in urban environments	Ben Swanson, Gavin McMeeking
11:50-11:55	Small-footprint mass spectrometry based chemical sensors for urban monitoring	Wade Rellergert, Scott Sullivan
11:55-12:00	Mobile Urban Aerosol Composition using a Robust Multi-pass Cell and Mid-infrared Fingerprint Region Spectroscopy	Brian Leen
12:00-12:05	Miniaturized weather station with rapid switching between precipitation and meteorological measurement modes	Allan Reaburn
12:05-12:25	<b>Lightning Talk Q&amp;A</b>	



# Atmospheric Radiation Measurement User Facility

ADAM THEISEN

**Instrument Operations Manager**

Slides and content provided by Jim Mather, Beat Schmid, and Andy Glen



# The World's Foremost Ground-based Atmospheric Observing Facility



Measurements of clouds, aerosols, precipitation, radiation, surface properties, and the atmospheric state since 1992

Support for process studies and model and satellite development



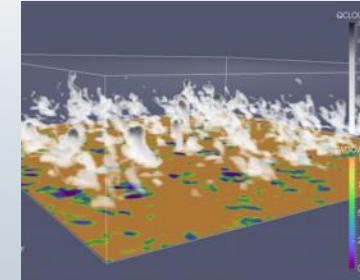
Network of three fixed-location and three mobile observatories



Piloted and uncrewed aerial measurement platforms



Extensive data management infrastructure; data freely available



Large-eddy simulation (LES) model simulations and analysis tools



Support for field campaigns ranging from guest instruments to facility deployments





# Observations Support Atmospheric Research



## MISSION:

Provide the research community with strategically located atmospheric observatories to improve the understanding and representation in earth system models of clouds and aerosols and their interactions with the Earth's surface.



# Unique Measurement Capabilities Deployed in Diverse Climate Regimes



## Southern Great Plains

- N. Central Oklahoma



## North Slope of Alaska

- Utqiagvik, AK



## Eastern North Atlantic

- Graciosa Island, Azores



## ARM Mobile Facilities

- AMF1 – Baltimore, MD
- AMF2 – Tasmania, Australia
- AMF3 – Bankhead National Forest, AL



# Advancing Atmospheric Insights with Comprehensive Ground-based Observations



- Operate 379 ground-based instrument systems run in tandem with each other to provide a comprehensive view of the atmosphere
- Diverse set of lidars across all observatories
- Extensive radar capabilities
  - 32 radars across 9 different frequencies
- Aerosol Observing Systems deployed at each observatory
  - NSA aerosol measurements are a collaboration between NOAA and ARM
  - ARM deployed aerosol chemical speciation monitor, aerodynamic particle sizer, and single-particle soot photometer to the NOAA facility

	Measurements (Instrument)	AMF1	AMF2	AMF3	SGP	ENA	NSA
SGF	<b>Aerosol Absorption</b> Continuous Light Absorption Photometer						X*
	<b>Aerosol Extinction</b> Cavity Attenuated Phase Shift Extinction Monitor			X			
	<b>Aerosol Number Concentration 0.003-3µm</b> Condensation Particle Counter Ultrafine	X	X	X	X		
NSA	<b>Aerosol Number Concentration 0.01-3µm</b> Condensation Particle Counter Fine	X	X	X	X	X	X*
	<b>Aerosol Scattering</b> Nephelometer	X	X	X	X	X	X*
ENA	<b>Aerosol Size Distribution 0.002-0.15µm</b> Nano Scanning Mobility Particle Sizer				X		
	<b>Aerosol Size Distribution 0.01-0.5µm</b> Scanning Mobility Particle Sizer			X	X	X	
	<b>Aerosol Size Distribution 0.06-1 µm</b> Ultra-high-sensitivity Aerosol Spectrometer	X	X	X	X	X	
AMF	<b>Aerosol Size Distribution 0.5-20 µm</b> Aerodynamic Particle Sizer	X	X	X	X	X	X
	<b>Black Carbon Concentration</b> Aethalometer - Filter	X					X*
	<b>Black Carbon Concentration</b> Single-particle Soot Photometer - Laser	X**	X**	XR			XR
AMF	<b>Carbon Monoxide Concentration</b> CO Analyzer	X	X	X		X	
	<b>Chemical Composition</b> Aerosol Chemical Speciation Monitor	X		X	X		X
	<b>Cloud Condensation Nuclei Concentration</b> Cloud Condensation Nuclei Particle Counter	X	X	X	X	X	
Other	<b>Hygroscopicity</b> Humidified Tandem Differential Mobility Analyzer	X		X			
	<b>Ice-Nucleating Particle Concentrations</b> Ice Nucleation Spectrometer – Filter	X	X	X	X		
	<b>Ozone Concentration</b> Ozone Monitor	X	X	X	X	X	
	<b>Sulfur Dioxide Concentration</b> Sulfur Dioxide Monitor	X		X	X		





# ARM Aerial Facility (AAF)



## ■ Platforms

- Bombardier Challenger 850 (CL850) regional jet
  - Under modification
- Navmar ArcticShark uncrewed aerial system (UAS)
- Instruments/measurements
  - Over 90 in house (Challenger 850 and ArcticShark)
  - Atmospheric thermodynamics, clouds, aerosols, precursor and trace gases, radiation, surface properties

## ■ Tethered Balloon Sonde (TBS)

- Typical maximum flight altitude: 1.5 km
- Aloft wind speed cutoff: 14 m/s
- ADS-B out transponder
- Night flights are currently permitted at SGP; others could be possible



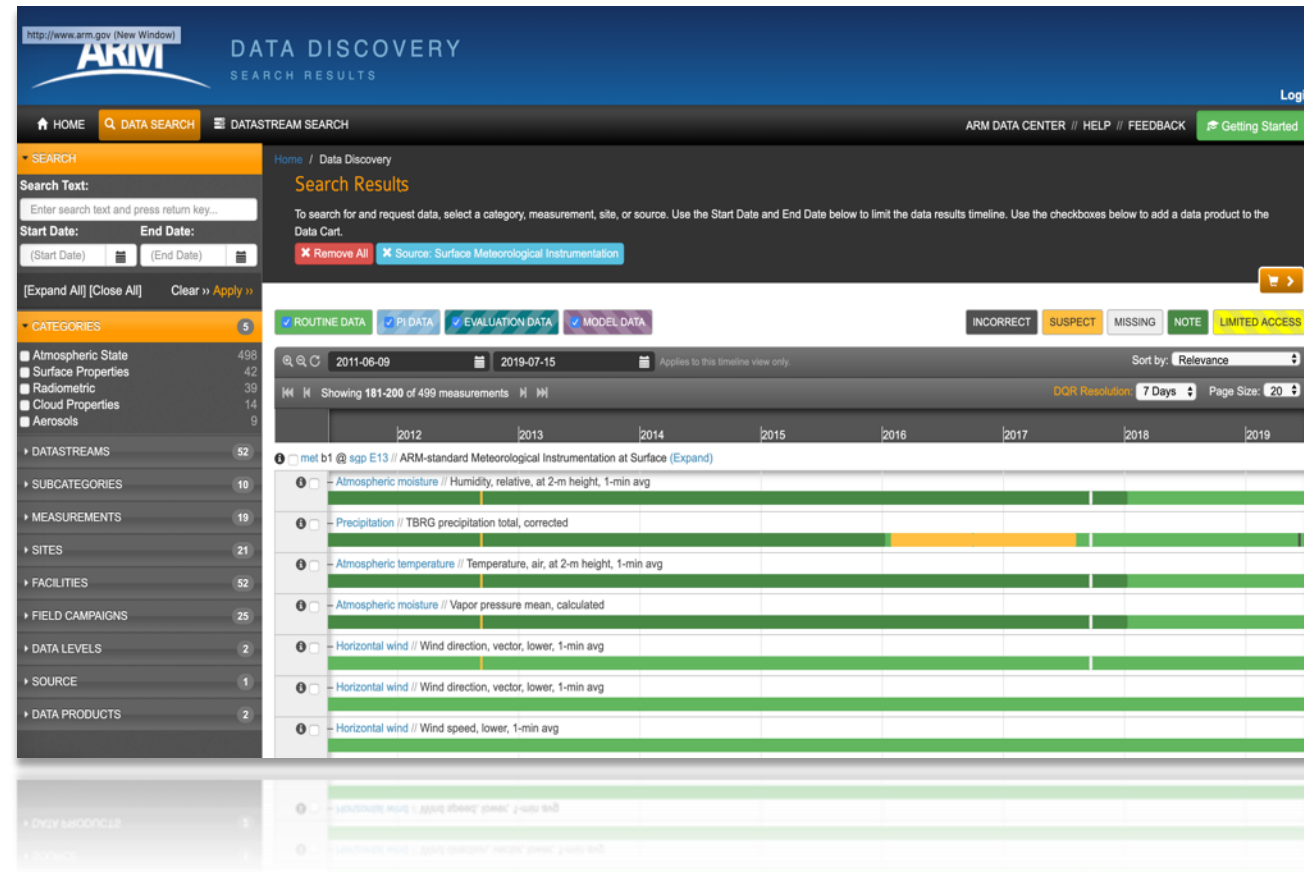


# Accessing ARM's Data



- ▶ **Free** to anyone that wants to use it!
- ▶ Register with ARM for an account to start accessing data
- ▶ Open-source Python software available for working with ARM's data
  - Atmospheric data Community Toolkit (ACT)
  - Python ARM Radar Toolkit (Py-ART)

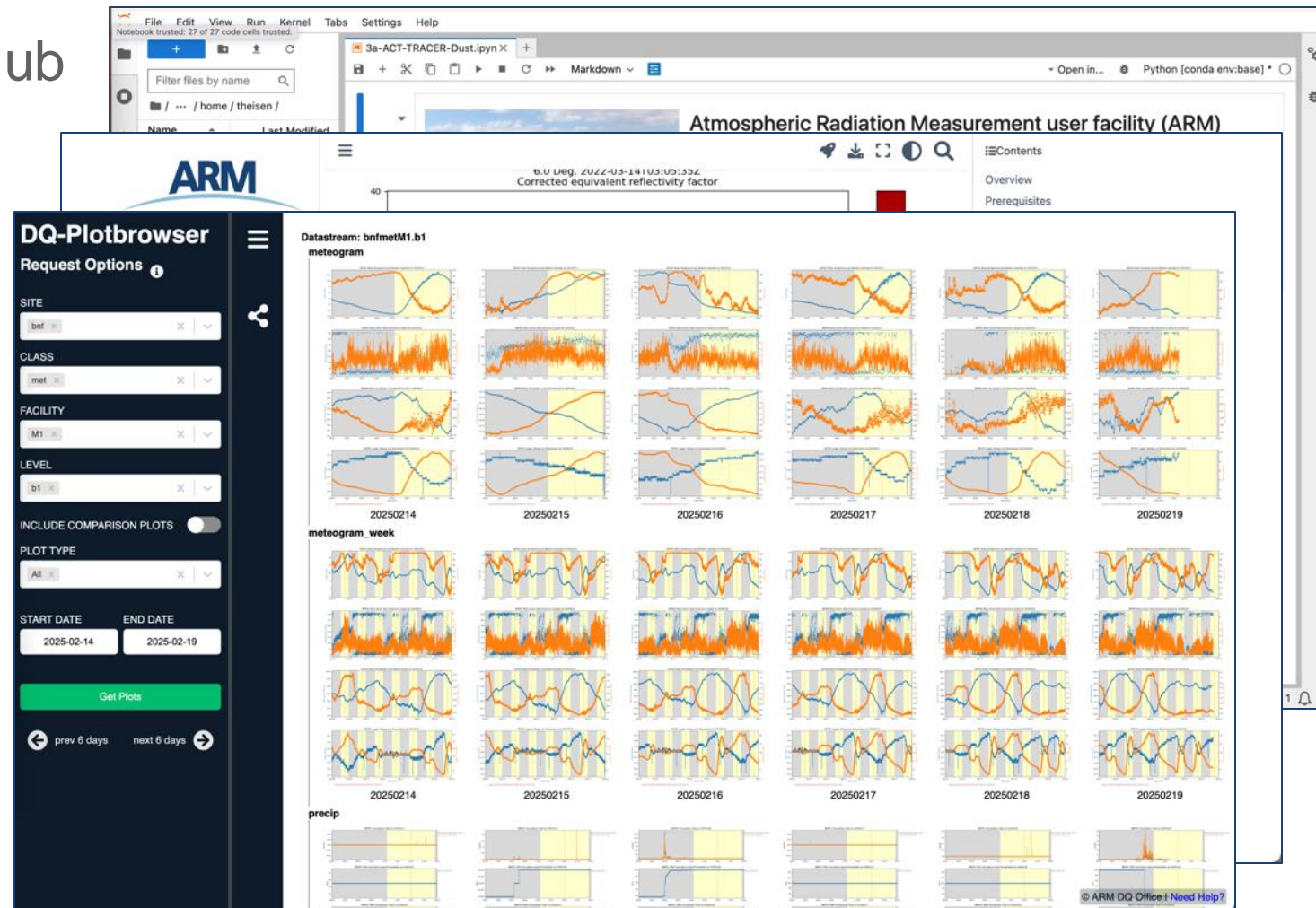
~7+ Petabytes



# Additional Resources



- ARM's Data Workbench/JupyterHub
- ARM-Notebooks Repository
- Data Quality Office Quicklooks





# Leveraging ARM Facilities Field Campaign Process & Operations

NICKI HICKMON

ARM Associate Director for Operations

Argonne National Laboratory (ANL)





# Types of Field Campaigns



- Year-round submission
  - Guest instruments at fixed or long-term sites
  - Modification or focused periods
  - Coordination with external field campaigns
  - High-performance computing cluster




# Types of Field Campaigns



## ■ Specific calls

- ARM Mobile Facility
- ARM Aerial Facility
- ARM-EMSL FICUS





Environmental  
Molecular  
Sciences  
Laboratory

A DOE OFFICE OF SCIENCE USER FACILITY

MENU

Home / Calls For Proposals / [Call For FICUS Research Proposals With ARM and EMSL, FY 2024](#)

**Call for FICUS Research Proposals with ARM and EMSL, FY 2024** **[Closed]**

### Timeline

February 9, 2023

Letters of intent due

February 22, 2023

Invitation of proposals

March 23, 2023

Full proposals due

July 31, 2023

Decision notices sent

October 1, 2023

Projects start

October 1, 2023

Projects start

The [Atmospheric Radiation Measurement \(ARM\)](#) user facility and Environmental Molecular Sciences Laboratory (EMSL) are seeking collaborative research applications through the Facilities Integrating Collaborations for User Science (FICUS) program. The FICUS program was established in 2014 to encourage and enable ambitious research projects, integrating the expertise and capabilities of multiple user facilities.

# ARM Campaign Webpage



## Reviews Require

- Proposal
- Instrument Support Request (ISR) for Guest Instruments

## Keys to Successful Proposals

- Submit on time
- Read the instructions
- Align with ARM Mission & DOE Goals
- Communicate with ARM

### CAMPAIGNS

### PUBLICATIONS

### RESEARCH HIGHLIGHTS

#### RESEARCH

## Campaigns

Proposals are accepted from members of the scientific community for conducting field campaigns using the Atmospheric Radiation Measurement (ARM) User Facility.

ARM provides the scientific community with the operational and logistical resources to conduct field campaigns using the ARM observatories that focus on advancing research in support of the ARM mission.

Priority will be given to proposals that make comprehensive use of ARM facilities, focus on strategic goals of the U.S. Department of Energy (DOE) Biological and Environmental Research (BER) program, and have the ability to improve regional or global earth system models.

Proposals that coordinate with other BER community capabilities or that support the goals of the Global Energy and Water cycle Exchanges (GEWEX) project are encouraged.



#### ARM USER PROFILE

ARM welcomes users from all institutions and nations. A free ARM user account is needed to access ARM data.

[REGISTER ▶](#)[LOGIN ▶](#)

#### DATA

[DATA DISCOVERY](#)  
[OBSERVATORIES & INSTRUMENTS](#)  
[CAMPAIGNS](#)  
[DATA USE GUIDANCE](#)

#### ABOUT

[CAREERS](#)  
[MEDIA OUTREACH](#)  
[LEADERSHIP & ORGANIZATION](#)  
[USER STATISTICS](#)

#### RESOURCES

[GLOSSARY](#)  
[ACRONYMS](#)  
[HELP](#)

#### RESOURCES

- ▶ [Proposal Deadlines Calendar](#)
- ▶ [Field Campaign Guidelines](#)
- ▶ [Expectations for Principal Investigators](#)
- ▶ [Campaign Process](#)
- ▶ [Propose a Field Campaign](#)
- ▶ [ARM Mission](#)
- ▶ [DOE BER Program Strategic Goals](#)
- ▶ [GEWEX Project Website](#)



# ARM Campaign Webpage



## Details Provided

- Deadlines
- Guidelines
- Links

GUIDANCE

Pro

Desirec

2025

Why

Cost to

Leve

Cam

U.S. DEPARTMENT OF  
**ENERGY** | Office of  
Science

DOE/SC-ARM-14-032

**Field Campaign Guidelines**

N Hickmon

Revision 8

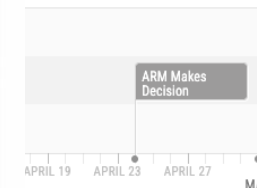
July 2023

**ARM**

field campaigns using the

### RESOURCES

- ▶ [Proposal Deadlines Calendar](#)
- ▶ [Field Campaign Guidelines](#)
- ▶ [Expectations for Principal Investigators](#)



# ARM Campaign Webpage



## Details Provided

- Announcements

### Updated: Propose for ARM FY2026 Tethered Balloon System Missions

Published: 3 January 2025

**Editor's note (February 11, 2025):** The calls below are both **CLOSED**.

#### Scientists can propose for new missions or request to analyze aerosol samples collected on flights

The Atmospheric Radiation Measurement (ARM) User Facility has two proposal calls open simultaneously for its [tethered balloon systems \(TBS\)](#).

For fiscal year 2026 (FY2026), ARM is now accepting preliminary proposals for TBS missions while also participating in a joint call with the [Environmental Molecular Sciences Laboratory \(EMSL\)](#). Like ARM, EMSL is a U.S. Department of Energy Office of Science user facility.

The ARM/EMSL call is supported through the [Facilities Integrating Collaborations for User Science \(FICUS\)](#) program. At no cost to them, FICUS awardees can use world-class ARM and EMSL resources and collaborate with scientific staff from both user facilities.

Through the new FICUS call, researchers can apply to use EMSL instruments to collect samples of aerosols and volatile organic compounds on ARM TBS flights and then conduct analysis using advanced laboratory techniques at EMSL. For information about the EMSL instruments available for this call, [read the ARM/EMSL FICUS FY2026 solicitation](#).

FICUS applicants may propose to analyze samples from past TBS missions or from planned missions at ARM's [Bankhead National Forest \(BNF\) atmospheric observatory](#) in northwestern Alabama or as part of ARM's [Coast-Urban-Rural Atmospheric Gradient Experiment \(CoURAGE\)](#) in Baltimore, Maryland.

The ARM-only call is for projects that **do not** require EMSL instruments and sample analysis.



In June 2024, an ARM tethered balloon system flies in the early morning during a campaign at the Southern Great Plains atmospheric observatory in Oklahoma. Photo is by Brent Peterson, Sandia National Laboratories.

ARM's [Southern Great Plains observatory](#) in north-central Oklahoma is part of the [Atmospheric Monsoon \(DUSTIEAIM\)](#) field campaign in Phoenix, Arizona.

are expected. [Learn about parameters for proposing new](#)

2025.

[L FICUS FY2026 solicitation.](#)

Ensure alignment of proposals to ARM and EMSL missions and requirements is available on [this FICUS guidance web page](#).

Proposals for the ARM-only call will follow the review procedure outlined for [ARM TBS field campaigns](#) and **must be submitted through ARM's [Propose a Field Campaign](#) page**.

The due date to submit preproposals for TBS missions through the ARM-only call is the same as the deadline to submit letters of intent for the FICUS call: **Tuesday, February 4, 2025**.

[Get More Information: ARM TBS Webinar](#)

For people interested in participating in either call and/or using TBS data in their research, ARM hosted a TBS webinar in January 2024. The webinar included information about ARM's TBS capabilities and data. [Watch the webinar recording now](#).

# ARM Campaign Proposals – For Overachievers



## Details Provided

- Announcements
- Expectations

## Consequences

- Final Campaign Report
- Guest Instrument Data

## Expectations for Principal Investigators

### Special Considerations

#### Uncrewed Aerial System (UAS) and Tethered Balloon Campaigns

- Campaigns proposing UAS or tethered balloon operations have additional requirements and longer timelines due to Federal Aviation Administration (FAA) and DOE Office of Aviation Management (OAM) regulations. The length required for this approval varies. The timeline can sometimes be shortened by securing a Certificate of Authorization (COA) ahead of time; however, we recommend initiating the proposal process at least 6 months prior to the intended start of the campaign.
- For sites where ARM has not previously operated UAS, and particularly international sites, the proposal process must be initiated at least 18 months prior to the start of the campaign.
- Use of small UAS may be proposed at any of the ARM atmospheric observatories.

#### Guest Instruments for AMF Campaigns

- ARM will consider logistical support for guest instrumentation associated with AMF campaigns.
- Due to additional logistical requirements (i.e., customs, shipping, etc.), each AMF campaign will have a cut-off date after which guest instrument support requests will no longer be accepted.

#### Instrumentation for Offsite Deployments

- ARM will consider deployments of non-critical spare instruments to principal investigators for offsite campaigns for periods of 6 months or less. Extensions may be requested.
- Principal investigators should clearly indicate what is requested of ARM for an offsite instrument campaign (e.g., shipping of instrumentation, operation or maintenance of instrumentation by ARM staff, or data processing) so that the total costs can be considered in the logistical review.
- Principal investigators may want to contact the ARM Instrument Coordinator for information about general instrument availability before submitting a preproposal.
- Instruments are expected to be returned to ARM in operational condition.

[CONTACT THE ARM INSTRUMENT COORDINATOR ►](#)

duct  
Campaign Data and  
Guidelines



# Proposal Form



## Details Provided

- Announcements
- Expectations

## Consequences

- Final Campaign Report
- Guest Instrument Data

## Propose a Field Campaign

Before submitting a field campaign preproposal to the Atmospheric Radiation Measurement (ARM) user facility, read the ARM Field Campaign Guidelines for an overview of processes and requirements. Guidelines for smaller campaigns (e.g., deployment of a guest instrument at an ARM site), tethered balloon system (TBS) missions, and the annual facility call are also available.

ARM reviews proposals on a quarterly, semi-annual, and annual basis as determined by the individual proposal classification. When submitting a preproposal, ensure that the proposed start date of the campaign leaves adequate time for the review and approval process.

### GUIDELINES

- ▶ [Field Campaigns](#)
- ▶ [Small Campaigns](#)
- ▶ [TBS Campaigns](#)
- ▶ [Annual Facility Call](#)
- ▶ [Proposal Deadlines](#)

WHO

WHAT

ACRONYM

WHEN

WHERE

SCIENTIFIC FOCUS

RELEVANCE

PLAN

RESOURCES

INSTRUMENTS

AIRCRAFT

FUNDING

Who

SELECT LEAD SCIENTIST

**Choose the lead scientist** (a.k.a., principal investigator or PI).

- Enter the PI's last name and click search.
- Select the name of the desired person in the list that appears.

ADD CO-INVESTIGATOR

**Choose the co-investigator(s).**

- Enter the last name of the investigator and click search.
- Click on name of the desired person in the list that appears.
- Repeat for each additional co-investigator.

# Instrument Support Request



## ■ Shipping/receiving/handling

## ■ Operations and maintenance support

## ■ Electrical/laser/radiofrequency/radiation/chemicals

## ■ Other information

## ■ Other safety

- Compressed gas
- Cryogenics
- Work at height
- Arctic/polar/alpine
- Interface with ARM instruments

Select any needed ARM instruments or guest instruments that will be brought to the site. Select all that apply.

1. In proposing a campaign using the ARM mobile or aerial atmospheric observatories, review the lists of baseline instruments for [AMF1](#), [AMF2](#), [AMF3](#), and [AAF](#). Indicate which instruments are most critical for this activity, as it may not be feasible to deploy all instruments for every campaign.

2. If planning to bring a guest instrument/s on site, please submit an [Instrument Support Request \(ISR\)](#) for each guest instrument you plan to deploy at the time you submit your proposal. This provides ARM information about the instrument, including its power and data transfer requirements. ARM requires this information to assess deployment/removal needs, data connections, data/metadata information, electrical requirements, required operations and maintenance support, as well as safety. [The Infrastructure Management Board \(IMB\)](#) will review your request and determine logistical and potential cost impacts.

The screenshot shows the ARM Instrument Support Request form. At the top, there's a navigation bar with the ARM logo, 'ARM MAINTENANCE REPORTS', 'VIEW REPORTS', and a 'MY ACCOUNT' button. Below this is a dark blue header. The form itself is white with a light blue sidebar on the left containing tabs: 'Shipping / Receiving / Handling' (selected), 'Electrical', 'Laser', 'RF', 'Radiation', 'Chemicals', and 'Other Information'. The main content area is titled 'User \*' and contains fields for 'User ID' (11920), 'Name' (Nicki Hickmon), and 'Email' (nhickmon@arl.gov). Below this is a section for 'Argonne National Laboratory' with fields for 'Affiliation', 'Address1', 'Address2', 'City' (Lemont), 'State' (IL), 'Country' (US), and 'Zip Code' (60439). A note states: 'Please ensure your contact information above is correct as this is how the Site Operator will reach you. If you need to make corrections please updated your profile at <https://adc.arm.gov/armuserreg/>'. The 'Instrument System Name \*' field is empty. The 'Planned Deployment Dates \*' section has 'Start' and 'End' date pickers. A note says: 'Please remember you still need to fill out a Site Access Request'. The 'Brief Description of Instrument \*' field is empty. The 'Deployment Type' section has a dropdown menu with 'Field Campaign' selected. The 'Field Campaign \*' section has fields for 'Name', 'Start Date', 'End Date', and 'Primary Observatory'. The 'Operation Plans \*' field is empty. The 'Critical ARM Instruments' section has a table with columns 'Code', 'Name', and 'Remove'. The 'Requires Network Connection \*' section has radio buttons for 'Yes' and 'No'. A note says: 'Will your data be collected and processed by the site data system and transferred to the ARM Data Center? \*'. The 'Connect with ARM Instrument Mentors' button is present. The 'Shipping / Receiving / Handling' section has a note: 'How will your equipment be delivered to the site?'. A note says: 'Please remember to fill out the ARM Shipping Form'. The 'Approximate size and weight of equipment for shipping' field is empty. A note says: 'with crate and packaging'. The 'Will your equipment need to be stored prior to set up and/or after tear down?' section has radio buttons for 'Yes' and 'No'. The 'Will your shipping containers need to be stored during the deployment?' section has radio buttons for 'Yes' and 'No'. The 'Will you need site personnel to assist in loading, unloading and/or transport of equipment on site?' section has radio buttons for 'Yes' and 'No'. The 'Do you need any heavy lift equipment such as a crane or telehandler?' section has radio buttons for 'Yes' and 'No'. The 'Does your equipment contain/use lithium batteries?' section has radio buttons for 'Yes' and 'No'. The 'Installation / Uninstallation Information' section has a note: 'What is the size of the instrument?'.

- Campaigns and Accessing ARM Facilities
- Finding ARM Data
- Instruments and VAPs
- Report Data Quality Issues
- ARM Website and Communications
- ARM User Account
- Other

Contact Us

need help with ...

Campaigns and Accessing ARM Facilities

Finding ARM Data

Instruments and VAPs

Report Data Quality Issues

ARM Website and Communications

ARM User Account

Other

SEND MESSAGE



# Questions