U.S. DEPARTMENT OF ENERGY | Office of Science

DOE/SC-ARM-11-001

# ARM Climate Research Facility Quarterly Instrument Report

## Fourth Quarter: October 1–December 30, 2010

JW Voyles

January 2011

ARM CLIMATE RESEARCH FACILITY

## DISCLAIMER

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Office of Science, Office of Biological and Environmental Research

# Abstract

The purpose of this report is to provide a concise but comprehensive overview of Atmospheric Radiation Measurement Climate Research Facility instrumentation status. The report is divided into the following sections: (1) new instrumentation in the process of being acquired and deployed, (2) existing instrumentation and progress on improvements or upgrades, (3) proposed future instrumentation, and (4) Small Business Innovation Research instrument development. New information is highlighted in blue text.

# Acknowledgments

This report is developed largely from the information submitted to and managed within our Instrument Mentor Monthly Summary (IMMS) reporting system (http://www.db.arm.gov/IMMS/). Special thanks to our instrument team for providing timely and complete updates to the IMMS, to Kathy Doty, our developer and administrator of IMMS, and Dana Dupont and Rolanda Jundt, who ensure that this information is posted accurately on the ARM website.

# Contents

# 1.0 New Instrumentation

This section describes approved new instrument deployment and upgrade activities for the current fiscal year (FY).

## 1.1 ARM Initiative—Recovery Act Instrumentation


Through the American Recovery and Reinvestment Act of 2009, the U.S. Department of Energy's Office of Science received $1.2 billion. In late May 2009, DOE released approximately $54 million—90 percent—of the $60 million allocated to the ARM Climate Research Facility. The remaining 10 percent of the Recovery Act funds ($6 million) was released in August. During FY2011, ARM will complete tasks to purchase and deploy dual-frequency scanning cloud radars to all ARM sites, enhance several sites with precipitation radars and energy flux measurement capabilities, and invest in new aerosol sampling and aerial instrumentation. This is just a small sample of the planned enhancements that will result in 143 new instruments for the ARM user community. Please visit the ARM Recovery Act web page for updates: http://www.arm.gov/about/recovery-act.

Contact Jimmy Voyles at jimmy.voyles@pnl.gov for specific details related to Recovery Act tasks.

# 2.0 Existing Instrumentation

This section describes activities that are ongoing to improve the performance of or maintain existing instrumentation, including any planned or in-progress upgrades. The information is abstracted primarily from the Instrument Mentor Monthly Summary (IMMS) reports database (http://www.db.arm.gov/IMMS/), which can be used for a collective and historical view of instrument status. Individual IMMS reports may be reviewed by following links to specific instruments from instrument web pages (http://www.arm.gov/instruments). ARM Mentors provide updates to the IMMS under these categories:

1. Data Review
2. Instrument Performance Issues and Trends
3. Current Task Status
4. Near-Term Plans
5. Accomplishments.

Information related to the progress and status of instrument engineering is available from the Engineering Change Order (ECO) database (http://eco.arm.gov).

Helpful links to instrument-related ARM web pages are listed below:

- Instrument Systems and Mentors, http://www.arm.gov/instruments/contacts
- Instrument Locations, http://www.arm.gov/instruments/location
- Instrument Mentor Monthly Summaries, http://www.db.arm.gov/IMMS/
- Operations Status System (includes calibration), https://oss.arm.gov/oss.php
- Data Quality Reports, http://www.db.arm.gov/cgi-bin/PIFCARDQR2/SignIn.pl?form=dqr
- Data Quality Program, http://dq.arm.gov/.

## 2.1 Aerosol Measurements

**Aerosol Observing System (AOS)**

Mentor: Anne Jefferson, NOAA/ESRL/Global Monitoring Division (GMD)

There are no open engineering tasks related to the AOS instrument suite.

**Tandem Differential Mobility Analyzer (TDMA)**

Mentor: Don Collins, Texas A&M University

Engineering Change Request ECO-00587, *Develop Collection and Ingest for TDMA*. Data from the TDMA currently are acquired and processed by Don Collins. Processed data are then delivered to ARM on a monthly basis and stored in the IOP area of the ARM Data Archive as "beta data." An ingest is being developed to produce netCDF files for inclusion in the main Data Archive. The communications group is contacting Don Collins to develop a web area, enter instrument metadata, and edit the instrument handbook. The TDMA needs to have an entry added to the IMMS reporting system. Data are available at the Data Archive, and a draft of the instrument handbook has been delivered (http://www.arm.gov/instruments/tdma). This ECO will remain open until the instrument mentor and software developer work out the remaining data product and data delivery pattern issues.

## 2.2 Atmospheric State

**Balloon-Borne Sounding System (BBSS)**

Mentor: Rich Coulter (with Mike Ritsche and Donna Holdridge), Argonne National Laboratory

Engineering Change Request ECO-00769, *Add Cryogenic Frostpoint Hygrometer Launches at the SGP in support of GRUAN*, is approved. Mike Ritsche is the lead. The Global Climate Observing System (GCOS) Reference Upper Air Network (GRUAN) is an international reference-observing network, designed to meet climate requirements and to fill a major void in the current global observing system. Upper air observations within the GRUAN network will provide long-term high-quality climate records, will be used to constrain and validate data from space-based remote sensors, and will provide accurate data for the study of atmospheric processes. GRUAN has been identified by the climate community as

being required to generate long-term high-quality climate records, to constrain and calibrate data from more spatially comprehensive global observing systems (including satellites and current radiosonde networks), and to fully characterize the properties of the atmospheric column. The GRUAN requirement is to provide one cryogenic frostbite hygrometer (CFH) sounding per month. ARM is working with NOAA and the GRUAN Lead Center to establish support for the launches at the Southern Great Plains (SGP) site by providing base stations, supplies, balloons, gases, cryogenics, and storage containers for cryogenics, calibration supplies, and CFH sondes to obtain water vapor profile measurements into the lower stratosphere once per month.

Engineering Change Request ECR-00694, *Characterize the Temperature Dependency of the RH Sensor in the SurTHRef System*, is under review. Mike Ritsche is the leader. The goal, if initial analysis and review show promise, are to improve the initial conditions (T, RH) of the RS-92 sondes at launch time while providing National Institute of Standards and Technology (NIST) tractability of sensor calibrations. This request is on hold until further analysis and results of the technique are available.

**SuomiNet Global Positioning System (SuomiNet)**

Mentor: None (external data provided by SuomiNet/COSMIC). Rick Wagener, Brookhaven National Laboratory, is the infrastructure contact.

Please see http://www.unidata.ucar.edu/data/suominet/ and http://www.arm.gov/data/vaps/suomigps for the details on the SUOMIGPS data.

## 2.3 Carbon Measurements

**Carbon Dioxide Flux System ($CO_2$FLX)**

Mentor: Marc Fischer, Lawrence Berkeley National Laboratory

There are no open engineering tasks related to the Carbon Dioxide Flux System ($CO_2$FLX) instrument suite.

**Carbon Monoxide (CO) System**

Mentor: Sebastien Biraud, Lawrence Berkeley National Laboratory

There are no open engineering tasks related to the Carbon Monoxide (CO) instrument suite.

**Precision Carbon Dioxide Mixing Ration System (PGS)**

Mentor: Sebastien Biraud, Lawrence Berkeley National Laboratory

There are no open engineering tasks related to the Precision Carbon Dioxide Mixing Ration System (PGS) instrument suite.

## 2.4 Lidars

**Micropulse Lidar (MPL)**

Mentor: Rich Coulter, Argonne National Laboratory

Engineering Change Order ECO-00698, *Update MPLs to Fast Switching Polarization*, submitted by Rich Coulter, is approved. The ECO will upgrade each of ARM's MPLs to add fast-switching polarization. The plan is in process to have Sigma Space modify all six installed MPL systems.

**Raman Lidar (RL)**

Mentor: Rob Newsom, Pacific Northwest National Laboratory

There are no open engineering tasks related to the Raman Lidar (RL) instrument suite.

**Vaisala Ceilometer (VCEIL)**

Mentor: Vic Morris, Pacific Northwest National Laboratory

There are no open engineering tasks related to the Vaisala Ceilometer (VCEIL) instrument suite.

## 2.5 Meteorology

**Surface Meteorological Instrumentation**

Mentor: Mike Ritsche, Argonne National Laboratory (SMET, SMOS, SURTHREF, THWAPS, MET, METTWR [North Slope of Alaska (NSA) Site])

Engineering Change Request ECR-00672, *Upgrade Dynamic Rain Gauge Calibration System*, is approved. This task is in process to improve the characterization and performance of ARM's precipitation measurements. Component evaluation and testing continues.

**Tower – Meteorological Tower Systems (TWR)**

Mentor: David Cook, Argonne National Laboratory

There are no open engineering tasks related to the TWR instrument suite.

## 2.6 Microwave Radiometers

**Microwave Radiometer (MWR)**

Mentor: Maria Cadeddu, Argonne National Laboratory

The MWR provides microwave radiances (expressed as "brightness temperatures") obtained in the range of 23.8 and 31.4 GHz.

There are no open engineering tasks related to the MWR instrument suite.

**Next-Generation Microwave Radiometer 3-Channel System (MWR3C)**

Mentor: Maria Cadeddu, Argonne National Laboratory

The MWR provides microwave radiances (expressed as "brightness temperatures") obtained in the range of 22 to 30 and 90 GHz.

Engineering Change Order ECO-00664, *Next-Generation MWR Procurement/Deployment*, is approved for action. The ARM Working Groups and Science and Infrastructure Steering Committee (previously known as the ARM Science Team Executive Committee) have approved the competitive procurement of next-generation 3-channel microwave radiometers (MWR3Cs). The systems are specified to provide three channels operating at 23, 31, and 90 GHz. The strategy is to replace the current aging MWRs with systems that broaden ARM's measurement performance parameters and provide an economic product life cycle for the future. A procurement specification is in development based on the outcomes of the November 2007 "ACRF MWR Futures" workshop. The contract for the MWR3C was awarded to Radiometrics Corporation. The MWR3C systems are functioning to specification and are in the process of being deployed at our research sites. There are lingering performance issues with the positioners, which remain under engineering evaluation. Approaches to rain mitigation need to be completed.

**High-Frequency Microwave Radiometer (MWRHF)**

Mentor: Maria Cadeddu, Argonne National Laboratory

The MWRHF provides microwave radiances (expressed as "brightness temperatures") obtained in the range of 90–150 GHz.

There are no open engineering tasks related to the MWRHF instrument suite.

**NOTE**: The two high-frequency microwave radiometers (MWRHFs) are new instruments from Radiometer Physics GmbH that are still under testing.

**Microwave Radiometer Profiler (MWRP)**

Mentor: Maria Cadeddu, Argonne National Laboratory

The MWRP provides microwave radiances (expressed as "brightness temperatures") obtained at twelve frequencies in the range of 22–30 GHz (K-band) and 51–59 GHz (V-band).

There are no open engineering tasks related to the MWRP instrument suite from Radiometrics.

**Microwave Radiometer, G-Band (183.3 GHz) Water Vapor Radiometer (GVR)**

Mentor: Maria Cadeddu, Argonne National Laboratory

The GVR provides microwave radiances (expressed as "brightness temperatures") obtained in the range of 183.3 GHz.

There are no open engineering tasks related to the G-band (183 GHz) Vapor Radiometer (GVR) instrument suite from ProSensing Inc.

**NOTE**: There is also a G-band (183 GHz) Vapor Radiometer Profiler (GVRP) radiometer developed by Radiometrics under the U.S. DOE Small Business Innovative Research (SBIR) program. This system is also known as the MP183. The GVRP has 15 channels between 170 GHz and 183.31 GHz. This system has not completed the ARM baseline processes.

## 2.7 Radars

**Millimeter-Wavelength Cloud Radar (35 GHz)** (MMCR, or KaZR)

Engineering Change Order ECO-00810, *MMCR Upgrade – rename new radar*, is approved and assigned to Kevin Widener to complete the renaming of the MMCR radars to KaZR (Ka-band zenith-pointing radar). All documents and references are in the process of being revised.

Mentors: Kevin Widener, Pacific Northwest National Laboratory; Karen Johnson, Brookhaven National Laboratory

Engineering Change Order ECO-00551, *Refurbish Millimeter Wave Cloud Radar Antennas,* was begun in 2007, and over a 3-year period, the MMCR antennas will be refurbished and characterized on an antenna range. The spare antenna is complete, and the contract for the new feed and subreflector has been placed. Once these are completed, they will be installed on the antenna reflector and calibrated. The Barrow MMCR antenna will be refurbished first to avoid impacting planned field campaigns at SGP. Contract negations are in process for new antennas with a new contractor. For FY2008, two antennas with engineering and fabrication costs were approved for procurement and installation at the SGP and Tropical Western Pacific (TWP) sites. The SGP antenna is 10 ft in diameter, while antennas used at ARM's tropical sites are 6 ft in diameter. Two additional antennas were planned for FY2009 to support upgrades to ARM's TWP sites. The first two antennas (6 ft) were received from Millitech, Inc. The first will replace the 10-ft antenna while it is being evaluated for refurbishment at Millitech. If it is "refurbishable," it will get a new feed, subreflector, and radome and won't be gone too long from the site. If not, Millitech will build a new antenna, which will take considerably longer (~6-7 months). Either way, once a good 10-ft antenna is back, it will be reinstalled, and the 6-ft antenna currently being used at SGP will be forwarded to Darwin. Antennas were damaged in route to the SGP and are being returned to the vendor, Millitech, for re-characterization. Turnaround time is estimated to be 3 weeks for the 6-ft antennas. When the 10-ft antenna is sent for refurbishment or new manufacture, the turnaround time will be approximately 4–5 months for refurbishment or approximately 6–8 months if a new antenna is built. The Darwin MMCR had its new antenna installed (January 28, 2010). The last 6-ft antenna has been received at ProSensing. The 10-ft antenna is delayed due to equipment problems at the at the antenna range. The antenna is scheduled for delivery in early January 2011.

**W-Band (95-GHz) ARM Cloud Radar (WACR)**

Mentor: Kevin Widener, Pacific Northwest National Laboratory

Engineering Change Order ECO-00681, *SWACR: Sampling Strategy, Software, Products,* is approved and assigned to Pavlos Kollias to define scanning strategies, the operational modes, and the value-added products (VAP) that the SWACR is envisioned to produce. The final statement of work with Pavlos Kollias is in place.

**Radar Wind Profiler – 915, 1290 MHz (RWP)**

Mentor: Rich Coulter, Argonne National Laboratory

There are no open engineering tasks related to the 915- and 1290-MHz Radar Wind Profilers (RWPs) instrument suite.

## 2.8 Radiometric Measurements, Broadband

**Broadband Radiometer Station (BRS, SIRS, SKYRAD, GNDRAD, BSRN)**

Mentor: Tom Stoffel, National Renewable Energy Laboratory

Engineering Change Request ECO-00788, *SGP Radiometer Infrastructure Upgrades*, is approved to re-engineer the RCF infrastructure. Tom Stoffel is the engineering lead. The purpose of this ECR is to upgrade the BORCAL and IRCAL data acquisition systems and associated cabling. Procurements are ongoing, and work is progressing.

Engineering Change Request ECO-00781, *Establish Pyrgeometer Calibrations Traceable to the WISG*, is in approved to update the calibration technique for Precision Infrared Radiometers (PIR) (Pyrgeometers). Tom Stoffel is the engineering lead. The purpose of this ECR is to implement a new pyrgeometer calibration scheme as described in the work: "Stoffel T, I Reda, J Hickey, E Dutton, and J Michalsky. 2006: Pyrgeometer calibrations for the ARM Program - updated approach (Presented at Sixteenth Atmospheric Radiation Measurement (ARM) Science Team Meeting. Albuquerque, NM)." Based on discussions during the ASR Science Team Meeting, held in March 2010, the Broadband Radiometry instrument focus group, chaired by Chuck Long, has provided an update to the ECO outlining recommendations.

**Narrow Field-of-View (NFOV) Radiometer**

Mentor: Gary Hodges, NOAA/ESRL/GMD

There are no open engineering tasks related to the Narrow Field-of-View (NFOV) instrument suite.

**Infrared Thermometer (IRT)**

Mentor: Vic Morris, Pacific Northwest National Laboratory

Engineering Change Order ECO-00616, *Install IRTs in Ventilated Enclosures*, is in process to update our IRT enclosures. In implementing ECO-00345, *Install Zenith-Pointing IRT Network at SGP*, a HEPA-filtered, ventilated enclosure for the IRTs was designed that keeps debris and, incidentally, most rain, off the gold mirror and IRT lens. This enhancement is being implemented on the TWP and NSA IRT instruments. Vic Morris is leading this ECO. Danny Nelson, Jeff Zirzow, and Krzystof are tasked under Morris's direction to provide designs for SGP, NSA, and TWP respectively. Morris has recommended an enclosure solution for TWP; details are available within the ECO. ARM Mobile Facility 1 (AMF1) and ARM Mobile Facility 2 (AMF2) are now included in this task.

Engineering Change Order ECO-00368, *Increase Sample Rate of Infrared Thermometers*, is in process to increase the IRT sampling rate to 5 Hz. All systems are functioning except Nauru (see EWO-12288, *Update IRT Data Acquisition Software*). Communications latency issues are being resolved with the RocketPorts and fiber optic line drivers that are resulting in data collection problems.

## 2.9 Radiometric Measurements, Spectral

**Atmospherically Emitted Radiance Interferometer (AERI)**

Mentor: Dave Turner, Space Science and Engineering Center, University of Wisconsin

There are no open engineering tasks related to the Atmospherically Emitted Radiance Interferometer (AERI) instrument suite.

**Cimel Sun Photometer (CSPOT)**

Mentor: None (external data provided by NASA AERONET). Laurie Gregory, Brookhaven National Laboratory, is the infrastructure contact.

There are no open engineering tasks related to the Cimel Sun Photometer (CSPOT) instrument suite.

**Multifilter Rotating Shadowband Radiometer and Related Systems (MFRSR, MFR)**

Mentor: Gary Hodges, NOAA/ESRL/GMD

Engineering Change Order ECO-00659, *Add Two MFRs to the AMF Instrument Suite*, was entered to guide and document the addition of upwelling MFRs to the AMF. Gary Hodges is the leader. The first radiometer will be installed and verified during the AMF Azores experiment in FY2009, even though surface albedo at the AMF main site will not be representative of the local scale due to the dominant effects of the surrounding sea surface. A second upwelling MFR is proposed for addition to the AMF supplemental site during FY2010; a spare MFR head will be purchased then. Components are available, and the tower details are being finalized.

Engineering Change Request ECR-00688, *Add Functionality for MFRSR Campbell System at Latitudes > 50 deg*, submitted by Gary Hodges is approved for a FY2010 implementation. This revision to the MFRSR logger software will provide the capability of the MFRSRs to operate at latitudes greater than 50° latitude. Also, there are ongoing discussions related to an enhancement of the shadowband positioning to enable higher quality retrievals of aerosol optical depth. Also, the need to expand the memory of the MFRSR data logger is under consideration to extend buffering capabilities when communication to data collectors is not available.

Engineering Change Order ECO-00692, *Purchase Data Loggers and Heater Controllers for MFRSRs*, is approved and assigned to Gary Hodges. The task is to build and/or procure the spares necessary to support all ARM MFRSRs/MFRs. Components are on order.

**Rotating Shadowband Spectrometer (RSS)**

Mentor: Peter Kiedron, NOAA/ESRL/GMD

There are no open engineering tasks related to the Rotating Shadow-band Spectrometer (RSS) instrument suite.

**Shortwave Spectrometer (SWS)**

Mentor: Connor Flynn, Pacific Northwest National Laboratory

There are no open engineering tasks related to the Shortwave Spectrometer (SWS) instrument suite.

## 2.10 Precipitation and Rain

**Disdrometer (DISDROMETER)**

Mentor: Mary Jane Bartholomew, Brookhaven National Laboratory

There are no open engineering tasks related to the disdrometer instrument suite.

**Optical Rain Gauge SGP (ORG)**

Mentor: Mary Jane Bartholomew, Brookhaven National Laboratory

There are no open engineering tasks related to the Optical Rain Gauge (ORG) SGP instrument suite.

**NOTE**: There are also ORGs installed on the TWP and AMF metrological towers. Mike Ritsche is the mentor for these systems.

**Total Precipitation Sensor NSA (TPS)**

Mentors: Mark Ivey, Sandia National Laboratory; Jessie Cherry, International Arctic Research Center and Institute of Northern Engineering, University of Alaska Fairbanks

Engineering Change Order ECO-00773, *Improvements to Total Precipitation Infrastructure at the NSA*, is approved and assigned to Jesse Cherry. This provides an upgrade to the communications system for the TPS at Barrow. Currently the system depends on a wireless connection to both transmit and record the data. This ECO provides the addition of a data logger so that it can record the data even when the transmission system is disabled. The objective is to reduce the amount of data lost.

## 2.11 Sky Imaging

**Total Sky Imager (TSI)**

Mentor: Vic Morris, Pacific Northwest National Laboratory

Engineering Change Order ECO-00674, *Tasks Associated with TSI Camera and Software Upgrade*, is approved for implementation to provide an upgraded camera for the TSI. This ECO is approved with a hold pending the design review to ensure that cost and overall impacts are reasonable. Power plug adaptors were made, the remaining cameras were procured, and the enclosures were assembled. The spare TSI from AMF1 was received, and the process of determining the baseline clear-sky color image mapping for each camera began. Three of the cameras with enclosures and mounting hardware were delivered to Darwin. The TSI camera and software were replaced at the TWP Nauru site on September 16, 2010. The AMF2 system was updated during November 2010.

Engineering Change Order ECO-00644, *Subcontract to Upgrade TSI Software*, was approved to upgrade the TSI software to allow use of new versions of the Axis camera. Concepts to incorporate the packaging and mechanical design of the new version of the Axis camera will be covered in a new ECR. Progress continues; five of the six tasks are now completed. The final task to refine clear-sky reference images and seasonal azimuth angles is ongoing.

Engineering Change Order ECO-00625, *Upgrade TSI Control Boards*, was approved and is in process to update the control boards of the TSI-880 systems. This update will reconcile issues with the real-time clock and power supplies. The subcontract has been placed with Remote Measurement & Research Company (RMRCo), and the repairs and testing are successfully complete—two boards were repaired, and eight additional boards are being fabricated for spares.

## 2.12 Surface Fluxes

**Eddy Correlation Station (ECOR)**

Mentor: David Cook, Argonne National Laboratory

There are no open engineering tasks related to the ECOR instrument suite.

**Energy Balance Bowen Ratio (EBBR) Station**

Mentor: David Cook, Argonne National Laboratory

There are no open engineering tasks related to the EBBR instrument suite.

**Soil Water and Temperature System (SWATS)**

Mentor: Daniel Hartsock, University of Oklahoma

The soil water and temperature system (SWATS), deployed at the SGP site, is designed to provide information about the temperature of the soil and the status of water in the soil profile. Because the SWATS array is aging, the sensor arrays are undergoing a replacement program.

Engineering Change Order ECO-00493, *Replace Failing SWATS Sensors*, is in process to add new redundant sensor arrays that will be installed at all SGP extended facility sites. These will be installed in a phased manner: five sites per year over four years, beginning in 2005 with the sites having multiple failed sensors given highest priority. After the soil recovers from the installation process in 6–12 months, the new sensor array will be connected to the existing SWATS data acquisition system in place of the old sensor array. Sensor arrays for FY2009 from Campbell Scientific have arrived at the SGP and are calibrated and ready for installation. Daniel Hartsock has prepared a status report on the SWATS refurbishment, which is attached to ECO-00493. Baseline Change Request BCR-01508, *Implement New Calibration Coefficients for sgpswats,* is complete. The new sensors at E19 were hooked up on December 11, 2008, and the ingest has been turned back on at both sites. Data now look good for all three SWATS refurbishments. Currently, ARM is waiting for the new extended facility sites to begin installation so the new sensors can be installed there for the SWATS profiles.

# 3.0 Future Instrumentation Planning

The instrument planning activities of the ARM Climate Research Facility are dynamic processes driven by the unmet measurement needs of contributing scientists, maintenance, calibration, simulation fidelity, and performance improvement/evolution of instrument and measurement systems. The spatial and temporal configurations of ARM's instrument systems and associated research sites are reviewed against science/measurement needs—these are important discussions and provide input to future instrument planning. Instrument plan recommendations and priorities are deliberated by the ASR science working groups and vetted thorough the ARM Infrastructure Management Board for action.

Please contact Jimmy Voyles at jimmy.voyles@pnl.gov for additional information related to ARM instrument planning.

# 4.0 Small Business Innovation Research

The U.S. DOE Small Business Innovative Research (SBIR) web page is available at http://www.er.doe.gov/sbir/. The DOE SBIR program develops instrumentation that can be applied to the science and measurement objectives of the ARM Climate Research Facility.


www.arm.gov

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