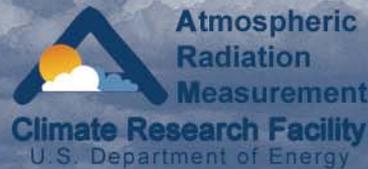


Current Status and Future Plans for ACRF Instrumentation

James Liljegren

ACRF Instrument Team Coordinator

2 November 2006



Overview

- 2006 Accomplishments: Instrument Acquisitions and Upgrades
- 2007-2009 Capital/Expense Equipment Plans
- SBIR Solicitation Status
- Summary – What I need from you...

New Instrumentation

- IRT (12) SGP: Nov-Dec 2005
- Disdrometer w/TBRG - Darwin: Dec 2005; SGP: April 2006
- Rain Gauge Dynamic Calibration Facility - SGP: August 2006
- W-band Cloud Radar - AMF: March 2006; SGP: April 2006
- IAP Cessna 206 new instrument suite - SGP: March 2006
- 2 per day soundings - Barrow: April 2006
- Shortwave Spectrometer - SGP: April 2006
- Total Sky Imager - Barrow: April 2006
- Micro-Pulse Lidar - SGP: May 2006; Darwin: Aug 2006; Barrow: Sep 2006; Manus, Nauru, AMF: Fall 2006
- Cimel Sunphotometer - AMF: July 2006
- IR Sky Imager - SGP: July 2006
- Hot Plate Total Precipitation Sensor - Barrow: Sep 2006
- CCN Counter - SGP: Sep 2006
- 90/150 GHz Microwave Radiometer - SGP: Oct 2006
- Add MFR to Cessna 206 - In progress

Instrumentation Upgrades

- MMCR PIRAQ-III Processor Upgrades - Darwin: Nov 2005, Nauru: Jun 2006, Manus: Aug 2006, Barrow: Fall 2006
- SWATS Sensor Array Replacements (5) - SGP: May 2006
- 915 MHz RWP Digital Receiver (PIRAQ-III) Upgrades (2) - SGP: Sep 2006
- AERI Rapid Sampling Upgrade - Darwin: Sep 2006, Nauru: Nov 2006, AMF: March 2007
- MFRSR Filter-Detector Replacements - 50% of filter-detectors received: Aug/Sep 2006
- MFRSR Datalogger Replacements - Fall 2006
- Raman Lidar Automatic Alignment Sensor - Fall 2006

Capital Instrumentation

<u>Item</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>
LIDARs				
New MPL (2 FY2005, 2 FY2006)	\$265,000			
MPL type-4b upgrade (2)	\$30,000			
MPL type-4 upgrade	\$55,000			
MPL Retrofit w/Coherent diode (2)	\$10,000			
MPL Polarization switching mod. (7)		\$12,000	\$60,000	
Raman Lidar Automatic Alignment	\$10,000			
New Raman Lidar (NSA)			\$350,000	

Capital Equipment (continued)

<u>Item</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>
RADARs				
MMCR PIRAQ-III Processors	\$21,500	\$40,000		
MMCR TWT	\$350,000*	\$70,000	\$70,000	\$70,000
MMCR Add Polarization at NSA	\$40,000			
MMCR Radome				
WACR EIKA (spare)	\$105,000			
WACR EIKA Modulator (spare)	\$90,000			
ARM Volume-imaging Array (AVA)		\$750,000	\$425,000	\$425,000
915 MHz RWP upgrades (5)	\$198,000	\$132,000		

*\$400,000 capital refund from ARM-UAV

Capital Equipment (continued)

<u>Item</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>
Microwave Radiometers				
90/150 GHz MWR (2**)	\$125,000			
Future MWRs (183 GHz, 3-ch replacement for current MWRs)			\$160,000	\$320,000
Aerosols				
CCN Counter for SGP	\$55,000			
Radiosonde				
DigiCORA-III for Manus, Nauru*	\$240,000			\$120,000
TOTAL	\$1,594,500	\$1,004,000	\$1,065,000	\$935,000

*\$400,000 refund from ARM-UAV

**1 in FY2005, 1 in FY2006

Expense Instrumentation and Upgrades

<u>Item</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>
RS92 sondes for 2 per day at Barrow	\$120,000	\$120,000	\$120,000	\$120,000
MMCR refurbish antennas (5)		\$80,000	\$80,000	\$40,000
MMCR upgrades (development cost)			\$200,000	
MMCR upgrades (per system cost)				\$40,000
AVA site prep and installation		\$100,000	\$100,000	\$100,000
AERI upgrade (Darwin, Nauru, AMF)	\$64,000			
AERI upgrade (NSA 2nd, spare)		\$47,000		
MFRSR filter-detector sets (100)	\$215,000 [†]			
MFRSR detector arrays	\$15,000			
MFRSR CR1000 data loggers (10)		\$15,000		
Add downward MFR to Cessna 206	\$30,000			
Radiometer Cal. Facility data system		\$60,000		
IRT (10 @ \$7,800 ea.)			\$78,000	



[†]ARM OPS 2005 carryover

Expense Instrumentation (continued)

<u>Item</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>
Aerosols				
Cimel Sunphotometer for AMF	\$30,000			
Replace AOS/OPC at SGP with APS added to TDMA		\$45,000		
Surface Meteorology				
SWATS sensors (5 sites)	\$13,000	\$13,000	\$13,000	
Hot Plate Precip Sensor (Atqasuk)		\$10,000		
Sonic anemometers (w spd, w dir), heated T/RH sensors at NSA (10)		\$65,000		
New T/RH sensors for EBBR (32)		\$12,000	\$12,000	\$12,000

Expense Instrumentation (continued)

<u>Item</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>
Instrument Development				
1.6 μm channel for MFRSR (10)		\$30,000		
RSS Refurbish / Overhaul		\$67,000		
Min: A-band spectrometer		\$198,000	\$195,000	\$172,000
Add cloud water phase to A-band		\$30,000	\$24,000	
Absolute Scanning Radiometer				\$250,000
Min: Modified MFRSR for LWP		\$100,000		
SUBTOTAL		\$425,000	\$219,000	\$422,000

Expense Budget

<u>Item</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>
Expense Equipment Budget	\$987,000	\$987,000	\$987,000	\$987,000
Data System Upgrades	\$213,000	\$276,000	\$251,000	\$268,000
Additional Mentor Effort (Petty:RL, Stoffel:PIR, Barnard:MFRSR)	\$70,000			
ETL MMCR support	\$15,000			
UAV support for TWP-ICE	\$168,000			
Reserve (Unanticipated Engineering Expenses)	\$200,000	\$200,000	\$200,000	\$200,000
Available Balance	\$321,000	\$511,000	\$536,000	\$519,000
EXPENSE INSTRUMENT TOTAL	\$272,000	\$992,000	\$822,000	\$734,000

2007 Default Ranking

<u>Item</u>	<u>Rank</u>	<u>Cost</u>	<u>Balance</u>
Available Budget			\$511,000
RS92 sondes for 2 per day at Barrow**	1	\$120,000	\$391,000
AVA site prep and installation**	2	\$100,000	\$291,000
MMCR refurbish antennas (5)**	3	\$80,000	\$211,000
A-band spectrometer**	4	\$198,000	\$13,000
Add cloud water phase to A-band**	5	\$30,000	(\$17,000)
RSS Refurbish / Overhaul	6	\$67,000	(\$84,000)
Sonic anemometers at NSA (10)	7	\$65,000	(\$149,000)
New T/RH sensors for EBBR (32)**	8	\$12,000	(\$161,000)
Radiometer Cal. Facility data system	9	\$60,000	(\$221,000)
1.6 μm channel for MFRSR (10)	10	\$30,000	
SWATS sensors (5 sites)**	11	\$13,000	
Replace AOS/OPC with TMDA/APS	12	\$45,000	
AERI upgrade (NSA 2nd spare)	13	\$47,000	

**multi-year item

DOE SBIR Status

- **183 GHz Microwave Radiometer**
 - Developed by ProSensing (phase-II award)
 - Deployed at NSA Barrow site in April 2005 (prototype)
 - Tuned up during summer 2006; currently in operation at NSA
- **FY 2005 Solicitation**
 - Added subtopic for A-band spectrometer
 - 1 successful phase I proposal: Dr. Fedor Dimov
 - Phase II proposal was NOT selected for funding
- **FY 2006 Solicitation**
 - Replaced A-band subtopic with eye-safe UV lidar for cirrus detection
 - Added aerosol phase function to aerosol measurements subtopic
 - Solicitation and other DOE SBIR information available at <http://sbir.er.doe.gov/sbir/>
- **FY 2007 Solicitation**
 - Instrumentation for small UAVs

What I need from you...

- Identification of deficiencies in ACRF measurement capabilities that affect this WG's science objectives and recommendations for addressing these deficiencies.
- Guidance and **ranking** on instrumentation plans.
- When? Input on measurement capabilities and instrumentation plans to Working Group Leader by December STEC Meeting.
- Suggestions for SBIR subtopics for FY 2008 solicitation by June 1, 2007.

Filter Chemistry Analysis

- \$80K/year (NOAA PMEL) for:
 - a time series of major cation and anion concentrations (Na^+ , NH_4^+ , K^+ , Mg^{+2} , Ca^{+2} , Cl^- , Br^- , NO_3^- , and $\text{SO}_4^{=}$) for the submicron and supermicron aerosol at SGP, NSA
 - a time series of submicron aerosol mass at SGP, NSA
 - a time series of submicron trace elements at NSA
 - SGP data available back to 2000; NSA back to 1997
 - IOP area of Archive
- Only 4 users