

**AERI data report No. 1**

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**UNIVERSITY OF WISCONSIN PARTICIPATION IN ICRCM PHASE II**

**YEAR I PROGRESS REPORT  
TO THE  
UNIVERSITY OF MARYLAND**

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## **University of Wisconsin Participation In ICRCCM Phase 11: Year I Progress**

The role of the University of Wisconsin (UW) in the DOE program "ICRCCM Phase II: Verification and Calibration of Radiation Codes in Climate Models" is to provide highly accurate measurements of downwelling thermal spectra, and retrievals of state parameters and cloud properties, as well as, spectroscopic analyses from the observations. The UW effort is divided into three major task areas: (1) Development and testing of a FTIR Spectrometer, (2) Participation in the Spectral Radiance Experiment (SPECTRE) field program, and (3) Data analysis. With the exception of our participation in the November SPECTRE planning meeting at the site in Coffeyville, Kansas, all of the efforts during the first eight months of the program have been directed at the FTIR spectrometer development.

### Approach

Our approach to spectrometer development makes full use of the complementarity of this effort and the UW instrument development for the DOE Atmospheric Radiation Measurement (ARM) program. When the UW participation in SPECTRE was first proposed, it was not clear whether a new uplooking instrument would be ready in time for the 1991 field experiment or whether the High-resolution Interferometer Sounder (HIS) aircraft instrument would be used. Since then, because a prototype of the new instrument has been assembled and tested, and because of our participation in the ARM program, we plan to have a reasonably mature new instrument ready for SPECTRE.

The availability of a new high-performance uplooking instrument for SPECTRE will allow us to make non-interfering uplooking and downlooking high spectral resolution observations in conjunction with FIRE. The HIS aircraft instrument will be flown on the NASA ER2, which will conduct frequent flights over the SPECTRE site. These unique coincident observations are expected to provide important new insights into the spectroscopic and radiative properties of the atmosphere.

### Specific Accomplishments

Specific accomplishments to date include system design and procurement efforts, tests of an improved approach to calibration, tests of the prototype blackbody temperature control and monitoring subsystem, and software development.

The overall system design has been established, using our current "Baby HIS" prototype instrument as a guide. The system components include a commercially available spectrometer, calibration reference sources and a scene switching mirror, a control and monitoring subsystem, and a data acquisition and analysis subsystem. The system for SPECTRE will also include an uplooking video camera for cloud monitoring.

Procurement of a spectrometer from BOMEM, Inc., Quebec, Canada has been initiated. Many options for both hardware and software have been evaluated and a purchase order has been placed. (Between this program and the ARM program, two instruments with somewhat different capabilities will be obtained in the next several months. Procurement procedures for the second instrument are currently being initiated. The first completed system will be tested and prepared for SPECTRE.)

Testing of our new calibration approach involved intercomparing sky spectra calibrated using one hot and one ambient blackbody reference source with those calibrated in our usual way using one ambient and one reference at liquid nitrogen temperature. The purpose of the new approach is to eliminate the need for a liquid-nitrogen-temperature reference, which requires frequent refills and which can introduce errors in humid environments. The main anticipated problem with the hot/ambient calibration is dealing with detector non-linearity. The outcome of the testing to date is that this effect is not large and can probably be accounted for accurately.

Prototype blackbody temperature control and monitoring subsystem testing was recently completed. The purpose of these tests is to evaluate the performance of the system for identifying areas needing improvement and for comparing with the performance of alternative designs. The subsystem makes use of two high emissivity cavity sources, originally constructed for the calibration of the UW Small-probe Net Flux Radiometer for the Pioneer Venus Multiprobe mission. The temperature servo system uses a single wire wound sensor/heater unit and temperatures are monitored with two thermistors in each cavity. The analog thermistor data is digitized by an A/D board on the IBM AT data acquisition computer bus. The tests results show the performance of the current subsystem to be adequate. However, design changes to make computer control of the subsystem more flexible and to improve the computer interface are being evaluated.

Finally, significant progress has been made in the software development for both calibration and display of the data products. This software development is crucial for thorough testing of the instrument performance and for quality control of the final data products.

### Summary

We are well on our way to making sure that a radiometrically accurate FITR spectrometer, data system, and software from the UW are ready for the SPECTRE field experiment next November.

# MEASUREMENT CONFIGURATION

