

The Status and Future of AERIs in ARM

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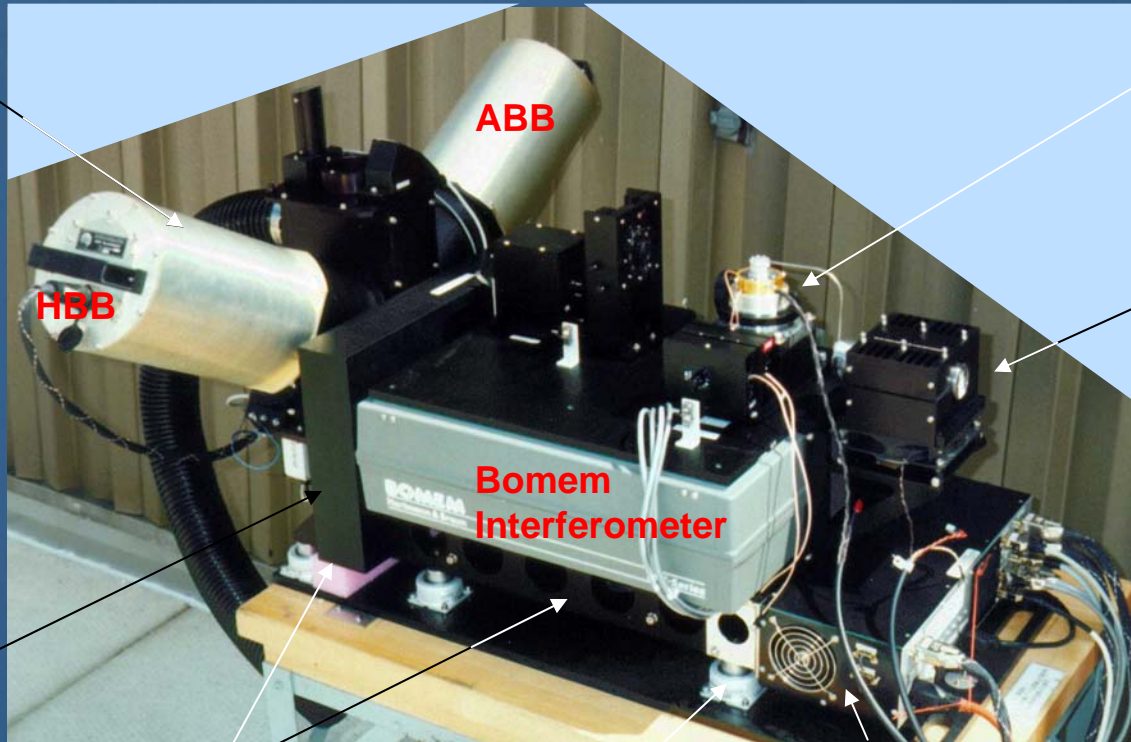
Background

- Spectrally resolved IR radiances were considered key component of ARM's observational strategy
- Stringent requirements placed on absolute radiometric accuracy (1% ambient radiance), spectral accuracy, noise level, and operability
- Instrument development was successful!
- ARM has 8 AERI systems:
 - SGP-01
 - SGP-E14
 - AMF-M1
 - NSA-C1 (ER)
 - TWP-C2
 - TWP-C3
 - Spare (NR)
 - Spare (ER)
- *11 Million* calibrated sky spectra have been collected by ARM AERIs (up to Dec 2007)

AERI Interferometer Assembly

Front End Assembly

Blackbodies
Scene Mirror Assembly
Forced Air Inlet
Rain Sensor
Sun Sensor



IR Detector
Dewar with
Cooler Cold Finger

Stirling Cooler
Compressor

Front-end
Closeout
(thermal)

Optics
Bench

Shock
Mounts (4)

Interferometer / AERI
Electronics Interface Box

AERI APPLICATIONS

Land-based



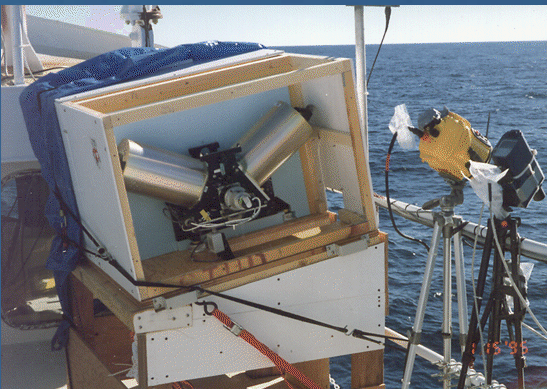
Primary Measurements

- Absolutely calibrated radiances
 - Spectroscopy / radiative closure

Retrieved Secondary Quantities

- Thermodynamic Profiling (T/q)
 - Atmospheric Stability
 - Fog Detection
 - Moisture flux monitoring
 - PBL height
- Cloud and aerosol properties
 - Cloud base height
 - Emissivity/Optical depth
 - Liquid Water Path (LWP)
 - Phase detection
 - Cloud particle size
 - Mineral dust composition
- Land/Water Surface skin temperature/emissivity
- Trace gas amounts

Oceanic-based



Aging ARM AERI Systems

- AERIs are over a decade old
- Recent HW/SW upgrade has extended AERI lifetime significantly
 - Replaced HW components no longer available, upgraded to more modern computer and OS
 - Allowed new science via rapid-sampling
 - Forced change of thermistor A/D card has degraded absolute accuracy
- Experiencing more HW failures recently
 - 4 failures in last 2+ yrs (interferometers)
 - Bomem no longer makes this particular model interferometer
 - Failure modes are unique and hard to diagnose
 - Ultimately may need to replace interferometer subsystem
 - Estimated quote from Bomem: \$165K / system (very rough)
 - Has some 1-time engineering costs that have not been determined

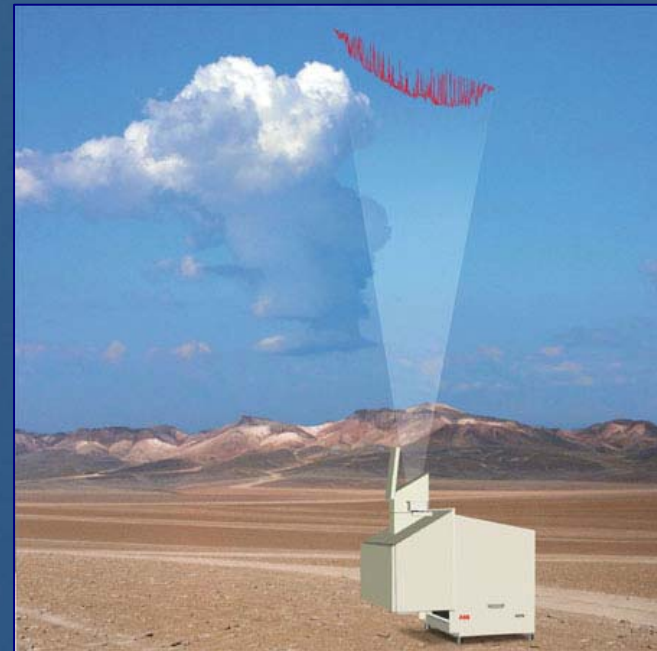
An AERI for the Second AMF

- Science Team will want an AERI in the 2nd AMF
- See four possible sources:
 - System from Nauru
 - But should this system be deployed at Manus?
 - Use one of the 2 spares
 - Recent rash of system failures may continue and thus increases odds of significant loss of data
 - Purchase a new system from Bomem
 - Gain experience with their latest technology
 - If successful, can start migrating older AERIs to new technology in a phased manner
 - Purchase a new system from SSEC
 - Will be most expensive option, but also less risky than above
 - Will also provide a path forward to migrate to new technology

3rd Generation AERI from Bomem

SSEC licensed AERI to ABB Bomem in late 1990's

- **Newly update with off the shelf components**
 - New MR series spectroradiometer technology
 - New integrated signal conditioning electronics
 - All components integrated into one enclosure
- **SSEC AERI blackbody sources**
- **New environmental protective enclosure**
- **Temperature stabilized FTIR and electronics**
- **Ethernet communication link to the computer**
- **Windows XP compatible software**
- **SSEC operational SW and calibration approach**
- **Systems 'certified' by SSEC before delivery to customers**

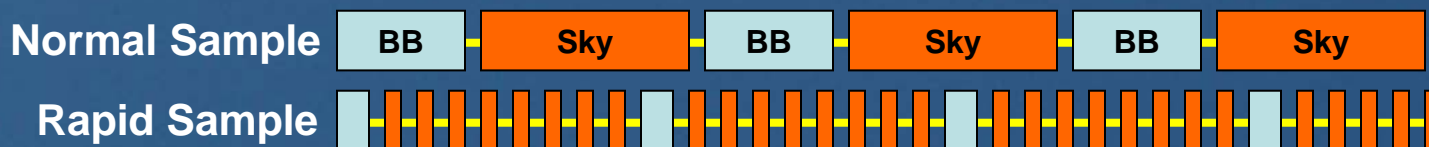


Bomem's estimated cost: \$250K

Email dated 6 Mar 2008 to F. Best

Other Current Mentor Tasks

- Hatch saga (Darwin, NSA, AMF)
 - Designed/built by mentors over yrs (\Rightarrow 3 separate designs)
 - Documentation on hatches thin, difficult troubleshooting
 - Getting this under control
- Trouble shooting Sterling coolers
 - Only one spare on hand, produced in batches
- Reprocessing data at NSA
- Migration of the AMF system to aerosol trailer
- Improving noise-filtering approach/SW



- NF removes uncorrelated noise
- Shorter BB avg. periods, together with more sky samples between BB views, creates temporally correlated noise
- Need to NF BBs, then calibrate sky views, then NF sky views
- Development of advanced DQ scripts/flagging