Technology Service Corporation
an employee-owned company

Open-Air Multiband Infrared Radiometer System (MIRS)

Technology Service Corporation (TSC) is developing a Multiband Infrared Radiometer System (MIRS) for open-air verification and validation (V&V) of infrared simulators and sources. The MIRS is turnkey, affordable, and largely COTS-based, and has been designed for reliable and practical operation in stressing environments. Multiple mid-wave infrared (MWIR) detector channels are configured in a single radiometer head, which is mounted on a mast system to facilitate source pointing and characterization at distance. Radiometer signals are digitized in the radiometer head allowing cable lengths of up to 200 feet to the Data Acquisition Unit (DAU). Cooling for the radiometer head is provided by a Vortex Cooler Unit, which operates on dry compressed air. An RF link capability allows remote operation and configuration of the MIRS as well as local display of real-time radiometer data. The system has the following features:

- Simultaneous data acquisition for up to three channels per radiometer head
- Expandability to multiple (multiband) radiometer heads
- 100 kHz data-sampling rate/10 kHz electronics bandwidth (bandwidth may be specified)
- Real-time data display/data averaging/data thresholding
- Xenon lamp beacon on radiometer head to facilitate source-beam boresighting
- Data acquisition times of up to 60 sec
- Intuitive LabVIEW Operator Interface for radiometer control and data acquisition/display
- Open-air operational capability for ambient temperatures from 40 °F to 120 °F
- Remote operation at distances greater than 5 km
- Externally mounted standard bandpass filters to define channel bandpass
- External DAU TTL start-trigger
- GPS/IRIG option for data time stamping/system synchronization

The radiometer system consists of a portable PC-based Data Acquisition Unit (DAU), a Power/Data Interface Unit (PDIU), a multi-channel Radiometer Head, a Vortex Cooler Unit (VCU) and related Air Dryer and Flow Meter units. A system diagram is shown below. The radiometer head contains the detectors and digitizing electronics. The HgCdTe detectors are DC-coupled and have low 1/f noise, making them ideal for low-frequency signal monitoring, while the 100 kHz sampling rate and 10 kHz electronics bandwidth allow high-frequency signal components, e.g., spikes to be observed (> 1 msec time resolution). The PDIU provides power to the radiometer head and interfaces the digital data from one or more radiometer heads to the DAU. The DAU acquires, stores, and graphically displays the radiometer data. Low Voltage Differential Signaling (LVDS) is used for all data cables.

Radiometer Channel	IR
Detector	HgCdTe
Wavelength Band	1 – 5 µm*
Sensitivity	2 x 10^{-8} W/cm^2
Dynamic Range	> 30 dB
Field of View (FOV)	20 deg
Sampling Rate	100 kHz
Electronics Bandwidth	10 kHz
Data Acquisition Time	Max 10 sec

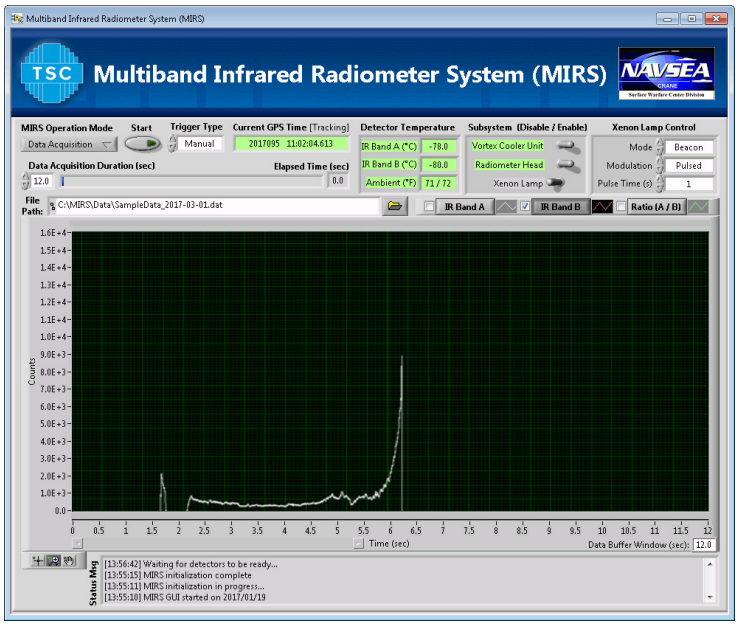
* tailored with external bandpass filter

THREE-CHANNEL MIRS RADIOMETER HEAD

The HgCdTe detectors are thermo-electrically (TE) cooled to -80 °C. Temperature monitoring of the detectors and the ambient air in the radiometer head is performed; all temperature data is displayed on the Operator Interface.

Standard 1-inch spectral bandpass filters and neutral-density (ND) filters can be externally mounted for each channel. Channel calibration is performed with a blackbody and can be adjusted to specific laser wavelengths.

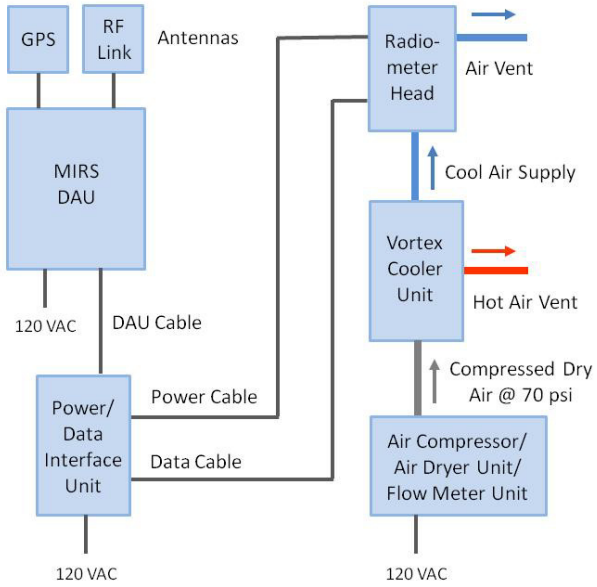
The LabVIEW Operator Interface provides real-time averaging and display of radiometer data. This is especially useful when boresighting a simulator beam. The simulator operator can locally view the simulator irradiance at the radiometer in real time as the beam is pointed. The xenon lamp beacon can also be used for boresighting.



LabVIEW Operator Interface

The Power/Data Interface Unit greatly reduces the radiometer head size and weight, which facilitates mounting of the head on the mast. The radiometer head housing is lightweight yet extremely strong, has designed-in mounting holes, and is NEMA rated. A sun shield is used to minimize direct heat loading.

TSC provides a 120 VAC electric air compressor (2 HP 30 gallons) to operate the Vortex Cooler Unit. A desiccant-based Air Dryer Unit and a Flow Meter Unit (1 – 10 SCFM) are also provided. Dry air at 70 psi and a flow rate of 6 SCFM is used. TSC can also provide a COTS-based mast system to position the radiometer head up to 15 meters above ground level. The Vortex Cooler Unit is mounted on the mast with the Radiometer Head.



MIRS System Diagram

TSC can customize an open-air radiometer system solution to meet your specific needs. Detector tradeoffs exist and AC-coupling is an option. Collecting optics can be configured to increase sensitivity. Calibration equipment and software/analyses packages can be provided.

ABOUT TSC

TSC has proven expertise in developing IR/UV simulators (including laser-based) and radiometers for Open-Air Range and Installed System Test Facility applications. We also have extensive experience supporting field testing in stressing environments and know what it takes to develop reliable and practical equipment and systems.

CONTACT INFORMATION

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