Portable Fourier Transform Interferometer (FTIR) System
Statement of Work

1 Introduction

NASA has a requirement for a portable Fourier Transform Interferometer (FTIR) System for conducting radiometric measurements at infrared (IR) wavelengths. The FTIR system will be primary used to measure the spectral Radiance of radiating sources emitting at, or near, room temperature under varying field and laboratory environments.

2 Specifications

The FTIR System shall meet or exceed the requirements described in the following sections.

2.1 System Configuration

2.1.1 The FTIR System shall include a spectroradiometer with two input and two output optical ports:

2.1.1.1 One input port shall be configured with a fixed reference cancellation source

2.1.1.2 The second input port shall be configured to accept a collimator for attaching a telescope

2.1.1.3 The two output ports shall be configured to accept IR detectors

2.1.2 The FTIR System shall incorporate a Stirling-cooled photovoltaic mercury-cadmium-telluride (MCT) IR detector having the following features:

2.1.2.1 4 to 13.5 µm wavelength response

2.1.2.2 16-bit analog-digital converter (ADC)

2.1.2.3 Computer-controlled gain selections of 1, 2, 4, 8, 16, 32, 64, 128, 256

2.1.3 The FTIR System shall incorporate a Stirling-cooled indium-antimonide (InSb) IR detector having the following features:

2.1.3.1 1 to 5.5 µm wavelength response

2.1.3.2 16-bit ADC.

2.1.3.3 Computer-controlled gain selections of 1, 2, 4, 8, 16, 32, 64

2.1.4 The FTIR System shall include the following optical components:

2.1.4.1 Input collimator

2.1.4.2 Motor-operated aperture wheel

2.1.4.3 4° field-of-view (FOV) telescope with manual focus and 2 m minimum focusing distance

2.1.4.4 1.5° FOV telescope with manual focus and 10 m minimum focusing distance

2.1.4.5 0.25° FOV telescope with manual focus and 30 m minimum focusing distance

2.1.4.6 Ocular eye-piece interchangeable with, or supplemented by, a charge-coupled detector (CCD) color camera featuring NTSC video output for collimator boresighting

2.1.5 The FTIR System shall include software for operating the spectroradiometer from a remote computer with the following capabilities:

2.1.5.1 Obtain measurements from both IR detectors simultaneously

2.1.5.2 Continuously record and save up to 30 minutes of spectroradiometer data to disk in real-time

2.1.5.3 Trigger data recording using an external signal provided to the computer from a remote device (via serial, parallel or other electronic interface)

2.1.5.4 Monitor and diagnose the operating status of the spectroradiometer

2.1.5.5 Provide control of the spectroradiometer's remotely-configurable settings

2.1.5.6 Perform post data acquisition analysis and processing

2.1.5.7 Perform radiometric calibration of the spectroradiometer in terms of Radiance, Irradiance and Intensity

2.1.5.8 Export data to Galactic GRAMS32

2.1.6 The FTIR System shall include a temperature control system internal to the spectroradiometer.

2.1.7 The FTIR System shall include a room-temperature cancellation reference source with the spectroradiometer.

2.1.8 The FTIR System shall integrate the electronic controls with the spectroradiometer assembly.

2.1.9 The FTIR System shall allow the spectroradiometer to be mounted and secured to a tripod platform using threaded fasteners.

2.1.10 The FTIR System shall include protective carrying cases to store and transport the spectroradiometer equipment.

2.2 Measurement Performance

2.2.1 The FTIR System shall have a root-mean-square (RMS) noise-equivalent spectral radiance (NESR) at 16 cm^{-1} resolution in the following wavelength bands:

2.2.1.1 NESR (RMS) below 2.5 X 10^{-9} $W/cm^2/sr/cm^{-1}$ at peak response between 4 and 13.5 µm.

2.2.1.2 NESR (RMS) below 2.5 X 10^{-10} $W/cm^2/sr/cm^{-1}$ at peak response between 1 and 5.5 µm.

2.2.2 The FTIR System shall have an optical throughput of 8.1 X10^{-3} cm^2-sr.

2.2.3 The FTIR System shall exhibit no more than 7.5% non-uniformity across 85% of the measured FOV.

2.2.4 The FTIR System shall provide 6 computer-selectable unapodized wavenumber resolutions of 1, 2, 4, 8, 16 and 32 cm^{-1} at all wavelengths.

2.2.5 The FTIR System shall have the following scan rates:

2.2.5.1 10 scans/sec at 1 cm^{-1} resolution.

2.2.5.2 17 scans/sec at 2 cm^{-1} resolution.

2.2.5.3 34 scans/sec at 4 cm^{-1} resolution.

2.2.5.4 54 scans/sec at 8 cm^{-1} resolution.

2.2.5.5 82 scans/sec at 16 cm^{-1} resolution.

2.2.5.6 107 scans/sec at 32 cm^{-1} resolution.

2.2.6 The FTIR System shall be spectrally stable to 0.01 cm^{-1}.

2.3 Electrical, Physical

2.3.1 The FTIR System equipment shall accept 115VAC/60 Hz, single-phase maximum electrical power (15 amps, maximum).

2.3.2 The FTIR System equipment shall adhere to the following weight and size restrictions:

2.3.2.1 Spectroradiometer weight: 35 kg (excluding collimator, telescope attachments)

2.3.2.2 Spectroradiometer size envelope: 40 cm X 40 cm X 40 cm (excluding collimator, telescope attachments)

2.3.3 The FTIR System equipment shall remain fully-functional and mechanically intact when subjected to the following environmental conditions:

2.3.3.1 Operating temperature: 0 to +45°C

2.3.3.2 Storage temperature: -30 to +55°C

2.3.3.3 Relative humidity: less than 90% (non-condensing atmosphere)

2.3.3.4 Operating altitude: 0 to 3 km

2.3.4 The FTIR System equipment shall operate in any orientation with respect to the ground plane under a 1 g static load.

2.3.5 The FTIR System shall remain fully-functional and mechanically intact following vibration load testing according to MIL-STD 810F, method 514.5:

2.3.5.1 Acceleration spectral density of 0.015 g^2/Hz from 5 to 40 Hz, decreasing monotonically to 0.0015 g^2/Hz at 500 Hz (along typical mounting direction)

2.3.5.2 Acceleration magnitude of 1 g RMS (along typical mounting direction), 0.63 g RMS (along remaining 2 transverse directions)

2.3.6 The FTIR System shall remain fully-functional and mechanically intact following shock load testing according to MIL-STD 810F, method 516.5:

2.3.6.1 6 g half-sine acceleration amplitude over 10 millisecond period

2.3.6.2 5 shock loads per direction (15 shock loads, total)

3 Documentation

The Contractor shall furnish all required documentation necessary to power, install, configure, calibrate, operate, administer, and maintain the FTIR System.

4 Warranty

All hardware and software shall be warranted in accordance with standard commercial practices, and shall cover all parts and labor. The warranty period shall begin after date of camera system delivery to NASA. Software and firmware maintenance shall be provided for a period of one year from date of acceptance.

5 Delivery

All deliverables shall be shipped to NASA no later than 24 weeks following contract award.