



George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

EM50-OWI-026
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ORGANIZATIONAL WORK INSTRUCTION

EM50

OPERATION OF

AVATAR 360 FT-IR SPECTROMETER

Revision C

APPROVING
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VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

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DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline		01-10-03	Baselined OWI
Revision	A	02-10-04	Revised to clarify warning/caution statements, to delete an inaccurate reference, and to add a note to use a funnel during liquid nitrogen filling operations.
Revision	B	08-25-04	Revised per HQ Rules Review Action.
Revision	C	04-27-05	Changes made due to reorganization

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OPERATION OF AVATAR 360 FT-IR SPECTROMETER

1. SCOPE

1.1 Scope.

This document establishes the organizational work instruction for operation of the AVATAR 360 FT-IR Spectrometer.

1.2 Purpose.

The purpose of this document is to outline the steps necessary for obtaining FT-IR spectra using the AVATAR 360 FT-IR Spectrometer and it's accessories.

1.3 Applicability.

This document applies to the AVATAR 360 FT-IR Spectrometer used by EM50. This work instruction is not a substitute for formal training. Untrained personnel shall not attempt to use this document to operate the AVATAR unless supervised by trained, certified operators.

2. APPLICABLE DOCUMENTS

	AVATAR 360 System Users' Guide
MPD 1280.1	Marshall Management Manual
EM50-OWI-002	Document and Data Control
EM50-OWI-003	Control of Quality Records
EM50-OWI-004	Control of Customer Supplied Product
MPR 8730.5	Control of Inspecting, Measuring, and Test Equipment

3. DEFINITIONS

Warning - Warnings are used when failure to observe instructions or precautions could result in injury to personnel.

Caution - Cautions are used when failure to observe instructions could result in damage to equipment.

Note - Information to help clarify multi-person procedures or simultaneous multiple operations.

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4. INSTRUCTIONS

Work performed and data generated within EM50 that affects the quality of products as specified in the scope of MPD 1280.1 shall be documented and controlled per EM50-OWI-002.

4.1 Instrument Purge Requirement

The AVATAR requires a missile-grade air or dry, high-purity nitrogen purge to eliminate moisture and carbon dioxide. The flow rate shall be set at 15 standard cubic feet per minute (SCFM) plus/minus 10 SCFM. Infrared spectra of empty sample accessories or empty sample compartments are used to confirm that moisture and carbon dioxide levels are acceptable.

To prevent moisture or other contaminants from condensing within the optics system, the purge shall be maintained or desiccant shall be placed inside the sample compartment when power has been disconnected.

Caution - Maintain a dry environment when power has been disconnected.

4.2 Selection of Analysis Accessory

Based on the sample characteristics, install the appropriate analysis accessory. Available analysis accessories include a horizontal attenuated total reflectance (HATR) sampler, sealed-cell sample holders with various pathlengths, sodium chloride plates, and a fiber optic probe.

It is beyond the scope of this document to describe the analysis accessory selection procedure or the complete applications for the available accessories. However, general practice in the EM50 laboratory involves the following:

- a. HATR: non-volatile residues, greases, oils, laboratory process support materials (e.g. gloves and wiper cloths)
- b. Fiber optic probe: surfaces requiring analysis for contamination
- c. Sealed cell: liquid samples (including small quantities of material to be analyzed dissolved in a carrier solvent)

4.3 Installation of Analysis Accessories

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Sampling accessories are changed within the main sample compartment as follows:

- 4.3.1 Open the sample compartment on the main optical bench.
- 4.3.2 Remove the four flat-head screws on the sampling accessory baseplate.
- 4.3.3 Lift out the current accessory.
- 4.3.4 Place the new accessory into position.
- 4.3.5 Replace the four baseplate screws.

Installation of the HATR and fiber optic probe accessories requires that the main sample compartment lid be removed. This is accomplished by fully opening the lid and then loosening the black setscrew.

Additional information regarding accessory installation is available in the operator's manual and in the OMNIC operating software by selecting "Help", selecting "Spectrometer Help Topics", selecting "Installing Optional Hardware", and then selecting "Installing Accessories".

4.4 Instrument Signal Stabilization

Electrical power shall be maintained to the instrument at all times. If power is disconnected, the instrument shall be allowed to stabilize for 15 minutes minimum after power is restored.

4.5 Pretest Preparation

The AVATAR detector shall be cooled to operating temperature using liquid nitrogen. The detector is cooled as follows:

Warning - Use appropriate personal protective equipment when handling liquid nitrogen, including safety goggles or face shield, gloves, safety shoes and a laboratory smock.

- 4.5.1 Open the dewar cover on the top, front, left-hand side of the optical bench (circular black cover).
- 4.5.2 **Slowly** pour in liquid nitrogen until the dewar is full.

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Note - Use a funnel to assist with the liquid nitrogen filling operation.

4.5.3 Replace the dewar cover.

4.5.4 Allow 15 minutes minimum for the detector to cool.

4.6 Pretest Preparation - Bench & Accessory Alignment

Ensure that the optical bench is properly aligned. The alignment procedure is as follows:

4.6.1 Remove any sample or accessory from the main compartment.

4.6.2 Select "Experiment Setup" from the toolbar or the "Collect" menu.

4.6.3 Ensure that the "Sample Compartment" on the "Bench" tab is set to "Main".

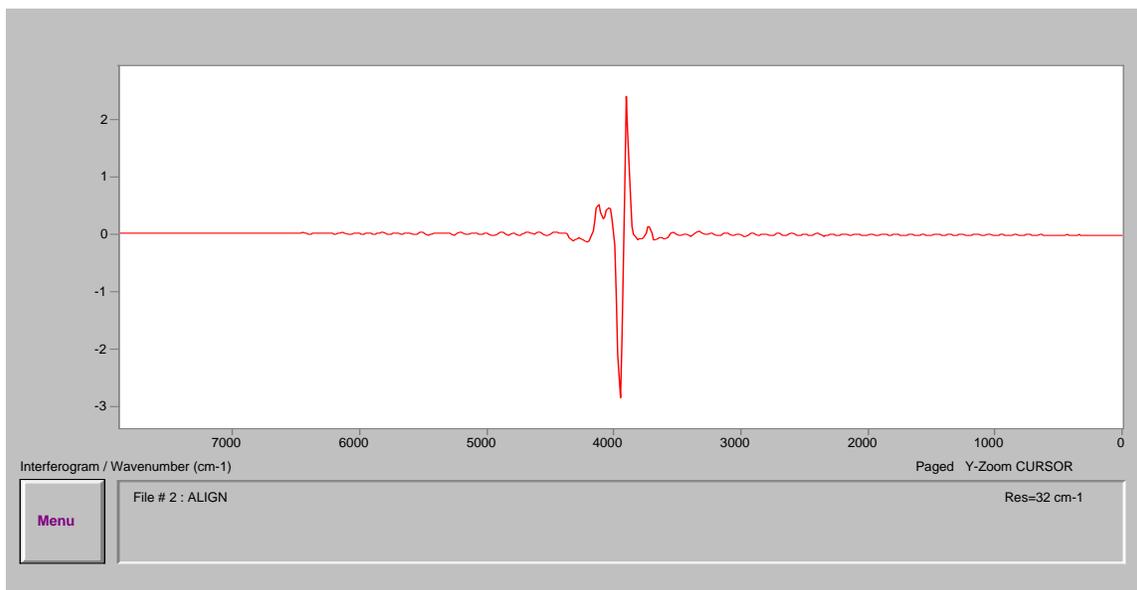
4.6.4 Set "Gain" on the "Bench" tab to 1.

4.6.5 Click the "Align" button on the "Diagnostic" tab.

Alignment is not required for the "Smart" accessories available for this instrument, which have a "smart chip" embedded on the back, right-hand side. Refer to the owner's manual for accessories that do require alignment.

An example acceptable interferogram is illustrated below:

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4.7 Sample Analysis

4.7.1 Samples shall be handled only with clean, approved gloves.

4.7.2 Identify the sample to be analyzed. If it is a customer-supplied sample it shall be logged per document EM50-OWI-004.

4.7.3 Select and install the appropriate analysis accessory as described in Sections 4.2 and 4.3.

4.7.4 Align the optical bench and analysis accessory as described in Section 4.6.

4.7.5 Select the optical bench and analysis parameters. Some of the AVATAR 360 accessories are "Smart", meaning that the instrument recognizes the accessory being installed and automatically sets default analysis parameters. Non-default settings are implemented by selecting the "Collect" menu, selecting "Experiment Setup", selecting the "Collect" tab, and then inputting the desired parameters.

4.7.6 Perform sample analysis as follows:

4.7.6.1 Collect a baseline spectrum by selecting the "Collect" pull-down menu and then selecting "Collect Background".

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Note - A baseline spectrum is obtained prior to sample analysis or following sample analysis. If the baseline is to be obtained following sample analysis, Section 4.7.6.2 shall be performed prior to Section 4.7.6.1

The baseline spectrum shall be obtained from an appropriate standard. A baseline standard for a reflectance analysis using the fiber optic probe is a clean sample of the same material type and surface finish as the potentially contaminated sample, or a gold reference standard. For sealed-cell analysis the baseline shall be obtained from the empty sample accessory or from clean solvent that will be used to dissolve the sample. For HATR analysis the baseline is obtained from the clean prism.

4.7.6.2 Collect the sample spectrum by selecting the "Collect" pull-down menu and then selecting "Collect Sample".

5. NOTES

None.

6. SAFETY PRECAUTIONS AND WARNING NOTES

This work instruction is not a substitute for formal training. Untrained personnel shall not attempt to use this document to operate the AVATAR 360 spectrometer unless supervised by trained, certified operators.

7. APPENDICES, DATA, REPORTS AND FORMS

When evaluating flight hardware or conducting in-process inspection of quality sensitive components, a data sheet shall be filled out with test results. This data shall be presented to Quality personnel for stamping. MSFC Quality may choose whether or not to be present for the sample analysis.

8. RECORDS

Records shall be retained in accordance with Document EM50-OWI-003. Copies shall be maintained in EM50 for a period of not less than 2 years.

9. TOOLS, EQUIPMENT, MATERIALS

As required.

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10. PERSONNEL TRAINING AND CERTIFICATION

The Group Leader of the Environmental Effects Group shall be responsible for ensuring that all personnel using the AVATAR 360 Spectrometer are trained. Training is accomplished by on-the-job training conducted by a representative of the Nicolet company and by a certified operator. Records of personnel training shall be kept in the group office.