

# Hyperion Tools 2.0 Installation and User Guide

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## Introduction

The Hyperion Tools plugin is designed to facilitate the use of Hyperion data in ENVI. Its most basic functionality is to convert Level 1R HDF and Level 1G/1T HDF and GeoTIFF datasets into ENVI format files that contain wavelength, full width half maximum, and band information. Also included are options specific to each input dataset format that further aid in using Hyperion data within ENVI.

Version 2.0 includes a complete overhaul of the underlying codebase, resulting in significantly faster conversion times, several new file output options, support for the new L1R format (L1R + AUX), and an application programming interface (API) that enables batch processing. The API is presented after brief discussions on the installation and use of the plugin.

## Installation

To add the toolkit to your ENVI installation, place the `hyperion_tools.sav`, `flag_mask_settings.txt`, and `hyperion_wl_fwhm_bbl.txt` files in your ENVI `save_add` and/or `extensions` folder. The location of this folder will vary by operating system and ENVI version.

ENVI 4.3:      Windows: `c:\rsi\idl63\products\envi43\save_add`  
              UNIX/Linux: `/usr/local/rsi/idl_6.3/products/envi_4.3/save_add`  
              Mac: `/applications/rsi/idl_6.3/products/envi_4.3/save_add`

ENVI 4.4-4.8: Windows: `c:\program files\itt\idlXX\products\enviXX\save_add`  
              UNIX/Linux: `/usr/local/itt/idl_X.X/products/envi_X.X/save_add`  
              Mac: `/applications/itt/idl_X.X/products/envi_X.X/save_add`

ENVI 5.0+ Standard: Windows: `c:\program files\exelis\enviXX\extensions`  
                      UNIX/Linux: `/usr/local/exelis/enviXX/extensions`  
                      Mac: `/applications/exelis/enviXX/extensions`

ENVI 5.0+ Classic:    Windows: `c:\program files\exelis\enviXX\classic\save_add`  
                      UNIX/Linux: `/usr/local/exelis/enviXX /classic/save_add`  
                      Mac: `/applications/exelis/enviXX /classic /save_add`

NOTE: To use Hyperion Tools in ENVI 5.0+, you must perform both the Standard and Classic mode installations.

To access the tools after installation, go to File->Open External File->EO-1->Hyperion Tools in ENVI Classic or double-click on the “hyperion\_tools” button in the Extensions folder in ENVI 5.0+.

## L1R Processing

For L1R data, click on “Input HDF” and select your L1R file. Then click on “Output Path” and select a destination folder for the new ENVI format version of the data. Click “Apply” to start the conversion process. In this mode, the conversion tool will place raw radiance data in the new ENVI file in BIL format and will include averaged wavelength and FWHM values. The new file shares the same rootname as the input HDF, but the extension is “.dat”.

### L1R Options:

- Attempt Georeferencing: If there is a metadata (.MET) file packaged with the L1R HDF that resides in the same folder as the HDF file, and it shares the same rootname as the HDF, the toolkit will parse the geographic coordinates for the four corners and include them in the new ENVI format file. The projection is only pseudo-geographic. Also, not all metadata files contain coordinates for the four corners, so the georeferencing might not work.
- Use Flag Mask Correction: A small number of Hyperion's detectors are malfunctioning, which often results in vertical striping in the image that can vary from one band to the next. Invoking this option gives you an image where the striping has been removed by replacing the bad values with ones linearly interpolated from the remaining good values on the same scan line. The correction is done on the fly as the original data is retrieved from the HDF and is placed in the new ENVI format file. The plugin uses the "flag\_mask\_settings.txt" file to guide the correction process. This file contains pre-launch detector health information on a per-pixel, per-band basis (256 x 242); it is also present in every L1R HDF file. You can modify the file to reflect post-launch health changes (0 = good, 1 = bad).
- Output ENVI Mask Image: This option instructs the toolkit to create an ENVI mask image (1 = good data, 0 = bad data) for the data set that suppresses the data acquired by the malfunctioning detectors. This especially helps when carrying out PCA rotations, Fourier Transforms, and Hourglass Processing with raw data that has not been flag-corrected. The mask image has the same basic rootname as the converted data file, but has "\_mask.dat" appended to it.
- Output Wavelength/FWHM Tables: Comma-delimited text files (CSV) are generated that include wavelength and full-width half maximum values for every band of every detector. These data are pulled directly from the supplied L1R file. The tables are organized so that bands (242) are the columns and detectors (256) are the rows. Bands increase from left to right and detectors increase from top to bottom.
- Output FLAASH Scale Factors: A small text file is generated in the specified output folder that contains scale factors necessary to correctly input Hyperion data into FLAASH. These scale factors are static (not derived from the inputted L1R file).
- Interpolate Data to Common Wavelength Set: Each detector in Hyperion's pushbroom array has slightly different band center and FWHM values for each band. This option performs a linear or quadratic interpolation across all detectors on a pixel by pixel, spectrum by spectrum, basis to a common set of wavelengths. The Bad Bands List is honored in this process as well to ensure the best possible results. The interpolation occurs on-the-fly during data conversion. The converted file includes wavelengths representing the new common set of band centers. Averaged values are used for FWHM. Linear interpolation is used unless the Quadratic button is toggled to "Yes".
- Use Quadratic Method: Toggle this button to "Yes" to use quadratic interpolation. The button becomes active when the user checks the Interpolate Data to Common Wavelength Set box.

### L1G/T Processing

For L1G/1T data, click on "Input MTL" and select the ".L1G" or ".LIT" metadata file that is packaged with the HDF or GeoTIFF files. Then click on "Output Path" and select a destination folder for the new ENVI format version of the data. Click "Apply" to start the conversion

process. In this mode, the conversion tool will place the radiance data in the new ENVI file in BIL format and will include averaged wavelength and FWHM values. The new file shares the same rootname as the input files, but the extension is “.dat”. All 242 files must be in the same folder as the MTL metadata file for the conversion to take place.

#### L1G/T Options:

- Output ENVI Mask Image: This option instructs the toolkit to create an ENVI mask image (1=good data, 0=bad data) for the data set that suppresses the “black” background present in the georeferenced imagery. This is useful for almost all ENVI processing since the background values are not part of the original dataset. The mask image has the same basic rootname as the converted data file, but has “\_mask.dat” appended to it.
- Output FLAASH Scale Factors: A small text file is generated in the specified output folder that contains scale factors necessary to correctly input Hyperion data into FLAASH. These scale factors are static (not derived from the inputted L1G/T file).
- Output Interleave: The interleave of the outputted cube can be set to Band Sequential (BSQ), Band Interleaved By Line (BIL), or Band Interleaved By Pixel (BIP). BIL is the default option.

### Using Hyperion Tools Output in FLAASH

To use toolkit output in FLAASH, go into the header file for the output and remove the first seven bands from the Bad Bands List. When FLAASH is done, go into the header file for the new output and put the seven bands back on the list.

# HYPERION\_TOOLS\_CONVERT\_L1R\_DATA

Use this procedure to convert Level 1R (L1R) data to an ENVI-formatted file and to output several support files.

## Syntax

HYPERION\_TOOLS\_CONVERT\_L1R\_DATA, FILE=string, OUT\_PATH=string,  
[/USE\_FLAG\_MASK], [/INTERPOLATE], [/QUADRATIC], [/GEOREFERENCE],  
[/GENERATE\_MASK], [/FLAASH\_SCALE\_FACTORS], [WL\_FWHM], [R\_FID=variable],  
[MASK\_FID=variable], [ERROR\_MSG=variable]

## Keywords

### FILE

Use this keyword to specify the fully qualified path to the L1R you wish to convert.

### OUT\_PATH

Use this keyword to specify the directory into which the converted file and any optional output files are placed. The string must end in the appropriate path separation character for your operating system (e.g., ‘\’ for Windows and ‘/’ for everything else).

### USE\_FLAG\_MASK (optional)

Setting this keyword indicates that you want mask out values from low-quality detectors and replace them with the average of the nearest good values.

### INTERPOLATE (optional)

Setting this keyword indicates that you want to interpolate spectra across all detectors to a common set of wavelengths. The default interpolation method is linear. Set the /QUADRATIC keyword to use quadratic interpolation instead.

### QUADRATIC (optional)

Set this keyword to use a quadratic method during spectral interpolation. This keyword is ignored unless the INTERPOLATE keyword is also set.

### GEOREFERENCE (optional)

Set this keyword to attempt a basic four-corner georeferencing of the L1R data.

### GENERATE\_MASK (optional)

Set this keyword to save the flag mask to an ENVI-formatted file.

## FLAASH\_SCALE\_FACTORS (optional)

Setting this keyword results in the output of a text file that contains a static list of per-band FLAASH scale factors.

## WL\_FWHM (optional)

Setting this keyword results in the output of comma-delimited text files (CSV) that contain the per-detector wavelength and full-width half maximum values stored inside of the L1R file.

## R\_FID (optional)

Use this keyword to specify the name of a variable that will contain the ENVI file ID (FID) for the converted L1R data. If the conversion process fails, the specified variable will contain a value of -1. The error message associated with this failure is returned via the optional ERROR\_MSG keyword.

## MASK\_FID (optional)

Use this keyword to specify the name of a variable that will contain the ENVI file ID (FID) for the optional flag mask file. If the GENERATE\_MASK keyword is not set, or the L1R conversion process fails, the specified variable will contain a value of -1.

## ERROR\_MSG (optional)

Use this keyword to specify the name of a variable that will contain an error message if the conversion process fails. If the process does not fail, the specified variable will contain a null string.

# HYPERION\_TOOLS\_CONVERT\_L1G\_DATA

Use this procedure to convert Level 1G (L1G) and Level 1T (L1T) data to an ENVI-formatted file and to output several support files.

## Syntax

HYPERION\_TOOLS\_CONVERT\_L1G\_DATA, MTL\_FILE=string, OUT\_PATH=string,  
[/GENERATE\_MASK], [/FLAASH\_SCALE\_FACTORS], [R\_FID=variable],  
[MASK\_FID=variable], [INTERLEAVE={0 | 1 | 2}], [ERROR\_MSG=variable]

## Keywords

### MTL\_FILE

Use this keyword to specify the fully qualified path to the MTL file associated with the L1G/T file you wish to convert.

### OUT\_PATH

Use this keyword to specify the directory into which the converted file and any optional output files are placed. The string must end in the appropriate path separation character for your operating system (e.g., ‘\’ for Windows and ‘/’ for everything else).

### GENERATE\_MASK (optional)

Set this keyword to create a mask image based on the background data value and save it to an ENVI-formatted file.

### FLAASH\_SCALE\_FACTORS (optional)

Setting this keyword results in the output of a text file that contains a static list of per-band FLAASH scale factors.

### R\_FID (optional)

Use this keyword to specify the name of a variable that will contain the ENVI file ID (FID) for the converted L1G/T data. If the conversion process fails, the specified variable will contain a value of -1. The error message associated with this failure is returned via the optional ERROR\_MSG keyword.

### MASK\_FID (optional)

Use this keyword to specify the name of a variable that will contain the ENVI file ID (FID) for the optional mask file. If the GENERATE\_MASK keyword is not set, or the L1G/T conversion process fails, the specified variable will contain a value of -1.

### INTERLEAVE (optional)

Set this keyword to indicate the desired interleave for the converted data:

- 0: BSQ
- 1: BIL (default)
- 2: BIP

### ERROR\_MSG (optional)

Use this keyword to specify the name of a variable that will contain an error message if the conversion process fails. If the process does not fail, the specified variable will contain a null string.