LizardTech

GeoExpress 10

Command Line User Manual

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Preface

The **GeoExpress Command Line User Manual** is written for geographic information system (GIS) professionals that want to compress and manipulate geospatial imagery with GeoExpress. This guide assumes that you have basic knowledge of GIS, including mosaics, coordinate reference systems, and multispectral imagery. This guide describes how to install and operate the command line version of GeoExpress.For installation instructions and other information about the graphical version of GeoExpress, see the **GeoExpress User Manual**.

Contents

Chapter 1: Before You Begin
GeoExpress overview

GeoExpress is a software solution for compressing and manipulating geospatial data. GeoExpress supports a broad range of file formats, including the industry standard MrSID format and the ISO standard JPEG 2000 format.

Some of the tasks that you can perform with GeoExpress include:

- Compress raster and LiDAR data;
- Create seamless mosaics;
- Specify separate compression ratios for individual bands in a multispectral image;
- Reproject raster images to another coordinate reference system;
- Perform color balancing;
- Crop and demosaick raster images;
- Despeckle raster images;
- Edit image metadata.

You can save images that you create with GeoExpress to your computer or a LizardTech Express Server. Then, view the images in the geographic information system (GIS) software of your choice, including Esri®, Bentley®, Autodesk®, and more.

What's new

> **NOTE:** To see a list of fixes and other information for the current version of GeoExpress, see the **GeoExpress Read Me.pdf** file included in the installation.

Version 10.0
New features

GeoExpress 10 has a greatly improved user interface that can help streamline your workflow. Among the improvements are:

- **Reworked Job Properties panel:** The new organization reinforces workflow from the top down, showing the same types of information about each job and allowing you to easily identify, review, and edit modifications made to each job.
- **Reduced number of dialogs**
- **Improved mosaic creation**
- **New crop options**
- **Simplified reprojection:** Improved CRS selection and editing, new CRS source, simplified WKT viewing and editing, and improved error checking
- **Jobs:** You can now pause or cancel jobs individually or en masse, and can manually re-order running jobs.

GeoExpress 10 also includes these new and enhanced capabilities:

- You can now crop and reproject LiDAR point clouds
- You can now create mosaics from multiple sources, including:
  - Create an MG2 mosaic from MrSID sources
  - Create a TIFF mosaic
  - Create a multiresolution MG2 mosaic
- Encoding NITF imagery no longer requires a separate license. Note that encoding NITF imagery will incur a charge against the data cartridge.
- The **Crop** window always displays an image preview. You can cancel the preview if it is taking too long to render, at which point you can enter crop coordinates manually.

Version 9.5.x

New feature highlights

- **Enhanced multi-core support:** GeoExpress no longer limits the number of concurrent jobs and threads to eight.
- **LiDAR Compression:** GeoExpress supports compressing LiDAR point clouds in plain-text or LAS or LAZ formats.
- **Multipolygon Shapefile Cropping:** Define the area that you want to crop with a shapefile that can contain multiple polygons.
- **Command line tools:** We improved the method used to create MrSID mosaics from the command line.
- **BPF support:** GeoExpress supports input and output of Binary Point Files often used in Geiger Mode LiDAR imagery.
- **NAD83 2011 support:** GeoExpress now supports EPSG Coordinate Reference Systems and Coordinate Transformations related to NOAA's National Adjustment of 2011.
- **PIX support:** GeoExpress supports PCIDSK (PIX) files as input files.
- **Improved transparency conversion:** GeoExpress uses the **nodata** value of the input image as the transparency for the alpha band when converting to MG4 format.
- **Color balancing improvements**
- **Simplified licensing**

Version 9.0 and 9.1

New feature highlights

- **Floating Point Support for MrSID Generation 4:** GeoExpress uses quantization to create 32-bit floating point images in the MrSID Generation 4 format.
- **Dynamic Range Metadata Generation:** Use GeoExpress to write dynamic range metadata for images.
- **Improved Metadata for Auxiliary Files**
- **Command Line Image Statistics**
- **Simple Job List:** Any images that you add to the GeoExpress graphical user interface appear in a single simplified job list.
- **Intelligent Encoding:** GeoExpress automatically performs a subset of image compression and manipulation operations without re-encoding images.
- **Image Rotation:** For images that include rotation metadata, GeoExpress creates rotated output images.
- **Custom Watermarks:** GeoExpress supports watermark images in BMP, PNG, and JPEG formats.
- **Mosaic Enhancements for the Command Line:** Create mosaics using multiple coordinate reference systems from the command line.
- **PNG Support**
- **NITF RPC Support:** GeoExpress can now interpret NITF files with RPC metadata.

System requirements

Before you install GeoExpress, verify that your system meets the minimum system requirements.

Hardware requirements

For optimal performance, verify that your system meets the following recommended hardware requirements:

- 2.5GHz quad core processor
- 4GB RAM
- 300MB of disk space for installation (additional space required for images)

However, it is still possible to run GeoExpress on systems with the following minimum hardware requirements:

- 1.5GHz processor
- 1GB RAM
- 300MB of disk space for installation, and additional space for images

Operating system requirements

> **IMPORTANT:** GeoExpress 10 is a 64-bit application and requires a 64-bit operating system.

Windows

- Windows 10
- Windows 8
- Windows 7
- Windows Server 2016
- Windows Server 2012 R2 Update
- Windows Server 2012
- Windows Server 2008 R2 SP1

Linux

> **NOTE:** On Linux, GeoExpress runs as a command line-only program.

- Red Hat Enterprise Linux 7.0
- Red Hat Enterprise Linux 6.1
- CentOS 7

Software requirements

On Windows, GeoExpress requires the following software to run:

- Microsoft .NET Framework 4.6.1
- Visual Studio C++ 2017 Redistributable
- SlimDX Runtime .NET 4.0 (used to display LiDAR point clouds in 3D)

If this software is not already on your computer, the GeoExpress installer will install it for you.

Getting GeoExpress

When you purchase GeoExpress, you can choose to download an installer for the Windows GeoExpress graphical and command line applications, an installer for the Linux command line application, or an ISO including all versions of GeoExpress as well as other applications, utilities, and sample images.

Download the software from the LizardTech website (https://www.lizardtech.com/support/geoexpress/installers).

Chapter 2: Installation and Licensing
Installing GeoExpress
Overview

To set up GeoExpress, complete the following steps:

- Run the GeoExpress installer to install the GeoExpress application.
- Enter a license code or connect to a License Server.
- If you have a copy of GeoExpress Standard Edition, install a data cartridge.

Installation

Before installing GeoExpress, log on to your computer with administrator permissions. You do not need administrative privileges to run the software once it is installed and licensed.

> **NOTE:** If you are upgrading from a previous version of GeoExpress, you must first uninstall the old version. For the Windows version of GeoExpress, this will happen automatically if you choose to install from the DVD Browser menu.

Installing GeoExpress for Windows

1. Log on to the computer where you want to install GeoExpress.
   You don't need to log on as an administrator but you do need to be able to perform admin overrides.
2. Navigate to the directory containing the GeoExpress installer and double-click SETUP.EXE to start the **GeoExpress Installation Wizard**.
3. The installation wizard prompts you to complete the following tasks:

   - Install the Microsoft .NET Framework, Visual Studio C++ Redistributable, and any other required libraries.
   - Accept the License Agreement.
   - Decide whether to share anonymous usage information.
     To change this option within the application, choose **Help > Anonymous Application Usage**.
   - Enter your serial number or choose to run GeoExpress in Trial mode.
     Serial numbers are specific to a version of GeoExpress, and determine the functionality available to you. For example, there are different serial numbers for GeoExpress Standard and GeoExpress Unlimited.
   - Select the directory where you want to install GeoExpress.
   - Follow the steps to complete the installation.

Installing GeoExpress for Linux

1. Log on to the system with superuser privileges.
2. Open a terminal and navigate to the directory where you downloaded the installer or insert a GeoExpress installation DVD into your DVD drive.
3. Run the installation shell script. For example, you might run the following command:

   `./install.sh`
4. Press **Enter** to read the license agreement and enter **Y** to accept.
5. Enter **Y** to begin the installation of GeoExpress.
6. Enter the file path for the directory where you want to install the product, or press **Enter** to accept the following default location:

   `/usr/local/LizardTech/GeoExpress/`
7. Optionally, if you want to allow users to request floating licenses from the computer, follow the prompts to install the License Server.
8. Optionally, if you purchased GeoExpress Standard edition and need to use a data cartridge, follow the prompts to install the Express Cartridge Manager (ECM).
   The installer finishes and displays the location of the environment variable setup script.
9. Navigate to the GeoExpress installation directory. If you installed to the default location, navigate to the following directory:

   `/usr/local/LizardTech/GeoExpress/`
10. Run the following command to export the GeoExpress environment variables to your current shell:

    `source GeoExpressEnvSetup.sh`

> **NOTE:** To add the environment variables to your shell permanently, copy the variables in the setup script to your shell initialization file. For example, if you use `bash`, copy the variables to your `bashrc` file.

Licensing GeoExpress

The first time that you run GeoExpress, you must enter a serial number (if you did not enter one during installation) and a license code, or connect to a license server. Otherwise, GeoExpress will run in Trial mode, which expires after 30 days.

License codes are specific to your computer system. You can request a permanent license code from LizardTech Customer Support. If you activate a temporary license code, you can switch to a permanent license code by editing the GeoExpress license options.

If you connect to a license server, you use a floating license that can be shared by multiple computers.

Requesting a license

1. Log on to the system where you installed GeoExpress with administrative privileges, then open a command prompt or terminal.
2. Run the `echoid` tool to get the locking code for your computer, and save the code to a text file. The locking code is a system-specific code used to generate a license unique to your computer.

   - On Windows, if you installed GeoExpress to the default location, run the following commands:
     ```
     cd C:\Program Files\LizardTech\GeoExpress\Tools\Admin
     echoid.exe > locking_code.txt
     ```
   - On Linux, if you installed GeoExpress to the default location, run the following commands:
     ```
     cd /usr/local/LizardTech/GeoExpress/tools
     ./echoid > locking_code.txt
     ```
3. Open a web browser and visit https://www.lizardtech.com/support/product-activation/.
4. Fill out the form and enter your locking code.
5. Click **Submit**. LizardTech Customer Support will respond within one business day.

> **NOTE:** If you use GeoExpress with a license server, you do not need to get your computer's locking code or ECM ID.

Entering a serial number

1. Log on to the system where you installed GeoExpress with administrative privileges, then open a command prompt or terminal.
2. Navigate to the GeoExpress `bin` directory.

   - On Windows, the `bin` directory is in the following location by default:
     ```
     C:\Program Files\LizardTech\GeoExpress\bin
     ```
   - On Linux, the `bin` directory is in the following location by default:
     ```
     /usr/local/LizardTech/GeoExpress/bin
     ```
3. Open the `lic_pref` license file in a text editor.
4. Edit the serial number line of the file to include your serial number. For example, you might enter the following:
   ```
   SerialNumber=YOUR-SN-GOES-HERE
   ```
5. Save the file.

> **NOTE:** If you want to use GeoExpress as a trial for 30 days, you do not need to enter a serial number. If you use GeoExpress with a license server, you must still enter a serial number.

Entering a license

1. Log on to the system where you installed GeoExpress with administrative privileges, then open a command prompt or terminal.
2. Navigate to the GeoExpress `bin` directory.

   - On Windows, the `bin` directory is in the following location by default:
     ```
     C:\Program Files\LizardTech\GeoExpress9.5\bin
     ```
   - On Linux, the `bin` directory is in the following location by default:
     ```
     /usr/local/LizardTech/GeoExpress9.5/bin
     ```
3. Open the `lservrc` license file in a text editor.
4. Enter the license code in the first line of the file. You can enter a temporary license code here until you receive a permanent license code from LizardTech Support.
5. Save the file.

Connecting to a license server

You can connect to a license server instead of entering a license code.

Append the `-useserver` switch to GeoExpress commands to connect to the license server. For example, you might enter the following command:

```
mrsidgeoencoder -i in.tif -o out.sid -useserver <licenseserver>
```

If the license server includes GeoExpress Standard licenses, you must also connect to an Express Cartridge Manager (ECM) Server to use a data cartridge. Append the -netecm switch to GeoExpress commands to connect to the ECM Server. For example, you might enter the following command:

```
mrsidgeoencoder -i in.tif -o out.sid -useserver <licenseserver> -netecm <ecm_
    server>:<port_number>
```

By default, the port number is 9002.

For more information on installing and configuring a license server and ECM Server, see Floating licenses on page 88.

Installing data cartridges

The standard edition of GeoExpress requires a data cartridge to create new compressed images. The data cartridge represents a specific purchased amount of data that you can use to create these images.

For more information about data cartridges, see Frequently Asked Questions on page 93 and Data cartridges on page 88.

Requesting a data cartridge

1. Visit https://www.lizardtech.com/sales/purchase/ to submit a data cartridge request.
2. Your sales representative will work with you to place your order.
3. LizardTech Customer Support will send your data cartridge file through email.

If LizardTech Sales or Customer Support needs additional information to process your order, they will contact you via email.

Installing a data cartridge

1. On the system where you installed GeoExpress, log on with administrator privileges, then open a command prompt or terminal.
2. Use the `umadmin` tool to install the data cartridge.

   - On Windows, if you installed the ECM to the default location, run the following commands:
     ```
     cd C:\Program Files\LizardTech\GeoExpress\ECM\bin
     umadmin.exe -add <path_to_cartridge>
     ```
   - On Linux, if you installed the ECM to the default location, run the following commands:
     ```
     cd /usr/local/LizardTech/ECM/bin
     ./umadmin -add <path_to_cartridge>
     ```

Chapter 3: Working with GeoExpress
Getting started

You can perform GeoExpress command line operations using the `mrsidgeoencoder` command. Use the `mrsidgeoencoder` command to perform all image compression and manipulation operations. To see the command line help, run `mrsidgeoencoder -h`.

For example, to perform basic lossless compression for a single image, run the following command:

```
mrsidgeoencoder -i input.tif -o output.sid -lossless
```

The command line version of GeoExpress also includes the following command line tools:
- `mrsidgeodecode`. Convert a MrSID or JPEG 2000 image to an uncompressed image format. Learn more
- `mrsidgeoinfo`. Display information about images in several common image formats. Learn more
- `mrsidgeometa`. Edit metadata for a MrSID or JPEG 2000 image. Learn more

Encoding

This chapter describes how to perform operations on single, raster MrSID images, including compression, cropping, and test encode operations.

- For information on working with LiDAR data, see LiDAR overview on page 55.
- For information on creating composite images and mosaics, reprojecting images, and creating Areas of Interest, see Advanced encoding options on page 24.
- For information on operations specific to other image formats, see JPEG 2000 encoding on page 58 and NITF overview on page 67.

Specifying input and output files

Encoding images with GeoExpress Command Line requires the use of several switches that identity the input and output files. Several more are optional. Many of the switches for input and output options are the same for raster and LiDAR data. Learn more

SWITCH	VALUE	NOTES
`-convertto8bit`		Converts incoming unsigned 16-bit data to unsigned 8-bit data during encoding. The switch gets ignored for input data that is not unsigned 16-bit.
`-input / i`	string	Identifies the input source file. It can be a full path name, or a path that is relative to the current working directory. Example: `-i foo.tif`

SWITCH	VALUE	NOTES

`-inputformat / -if`	string	Identifies the input file format. Accepted formats are:
		  `tif` or `tiff`: TIFF 6.0
		  `tifw`: TIFF 6.0 with TIFF world file
		  `tifg` or `geotiff`: GeoTIFF
		  `bbb`: BIP, BIL or BSQ format
		  `doq`: Digital Orthophoto Quadrangle (DOQ)
		  `doq_nc`: DOQ (no clipping)
		  `ras` or `rast`: Sun Raster
		  `lan`: ERDAS LAN
		  `sid` or `mrsid`: MrSID
		  `jpg` or `jpeg`: JPEG (not JPEG 2000)
		  `jp2`: JPEG 2000
		  `bmp`: Bitmap (BMP) (Windows only)
		  `nitf`: National Imagery Transmission Format 2.0/2.1 (NITF)
		  `img`: ERDAS Imagine

`-output / -o`	string	Identifies the name of the file that GeoExpress creates. It can be a full path, or a path that is relative to the current working directory. Example: `-o myfile.sid`

`-outputformat / -of`	string	Identifies the desired output format of the file that is to be encoded. Accepted formats are:
		  `mg2`: MrSID Generation 2 (MG2)
		  `mg3`: MrSID Generation 3 (MG3)
		  `mg4`: MrSID Generation 4 (MG4)
		  `gmljp2`: JPEG 2000 (GMLJP2)
		  `jp2`: JPEG 2000 (Part I)
		  `nitf`: raw NITF
		  `nitfjp2`: NITF encoded as JPEG 2000 (JP2)
		  `tiff`: GeoTIFF
		Default output format is MrSID Generation 4.

`-removealpha`	string	MG4 and JP2 only. Specifies that the alpha band should be discarded from the source image.

GeoTIFF limitations

GeoTIFF jobs can be cropped, but they do not have any additional encode options.

Input and output defaults

By default, GeoExpress sets the input format based on the input file extension. If the `-of` switch is not used, GeoExpress ouputs MrSID Generation 4 (MG4).

Examples

    `-i foo.tif -if tiff` (`foo.tif` is the input file, identified as a TIFF file)
    `-i foo.data -if tiff` (`foo.data` is an input file forced into being recognized as TIFF)
    `-i foo.tif` (`foo.tif` is the input file, with a file type of TIFF being inferred by the file extension `.tif`)
    `-o foo.sid -of mg2` (creates an MG2 file called `foo.sid`)
    `-o foo.sid -of mg3` (creates an MG3 file called `foo.sid`)
    `-o foo.sid` (creates an MG3 file called `foo.sid`)

Basic encoding switches

SWITCH	VALUE	NOTES
-alignpixels		Only for use with -reprores. Aligns the output image to an integer multiple of the output resolution. If you reproject an image and change the resolution, you may want to use this switch.
-applyRotation	boolean	True or false. For images that include rotation metadata, GeoExpress creates rotated output images. True is the default value. If you do not use this switch, GeoExpress creates rotated images by default.
-bandselection / -bands	string	Specifies the bands to extract from the source image and their order in the output image. Number of bands must agree with the target colorspace (for grayscale images a single band must be specified, for RGB images 3 bands, for CMYK images 4 bands). Band numbering starts at 1. REMAINDER specifies "all the other non-alpha bands". Default: REMAINDER. Example: -colorspace RGB -bandselection 5,3,2
-compressionratio / -cr	float	Cannot be used with the -perbandcompressionratio / -pbcr switch. Specifies how much compression is applied to an encoded file. This number is interpreted as a ratio, so a compression ratio of 20 will produce a file that is twenty times smaller than the uncompressed size of the input file. Example: -cr 10
-colorspace / -cs	string	Specifies the target colorspace. Valid values are rgb, cmyk, gray, multi and same. Target colorspace must agree with the number of bands in the -bandselection / -bands above argument. Default: same. For more information see Multispectral input images and the RGB transform on the next page. Example: -colorspace RGB -bandselection 5,3,2
-targetsize / -fs	string	MG3 and MG4 only. Specifies the desired size of the output file in bytes. For example, -fs 10000 creates an MG3 file that is 10000 bytes on disk.
-lossless		MG3, MG4 and JP2 only. Preserves all of the pixel data of the original source image. See Lossless encoding on page 17 for more information.
-maxlevels		Creates an output file with the maximum number of zoom levels that the input image supports.
-perbandgroupcompressionratio / -pbgcr	string	Cannot be used with -cr switch. Specifies compression ratios for groups of (non-alpha) bands in the output image. Applies to multispectral output only. See Setting per-band compression ratios on page 17 for usage and examples.

SWITCH	VALUE	NOTES
`-scale / -s`	sint	Specifies the number of zoom levels, or resolution levels, that the encoded image will have. For MG2, this number must be between 3 and 9 inclusive. For MG3 and MG4, any number greater than zero is supported. For JP2, the acceptable values are 1 through 12. (Note: The full resolution or base image is called the zero level and is not counted as one of the zoom levels. For example, setting the zoom level at three will result in three additional resolutions besides the base level.)
`-thumb`	int	Closely related to the `-scale` switch, specifies the target thumbnail size (in pixels), which is the size of the smallest zoom level. For example, `-thumb 32`creates a file with the number of zoom levels that comes closest to a 32 × 32 pixel thumbnail.
`-watermark`	string	Specifies the name of the watermark image that you want to use. See Watermarks on page 18.

> **NOTE:** The `-compressionratio` and `-targetsize` switches are mutually exclusive, as are the `-compressionratio` and `-perbandgroupcompressionratio` switches. The `-s` / `-scale`, `-thumb`, and `-maxlevels` switches are mutually exclusive.

Image rotation

Image rotation metadata describes the direction that an image should point. For example, an image might contain metadata that rotates an image so that it points north. GeoExpress creates rotated images with empty space in the corners. The empty space is compressed so that it does not add to the size of the image. This option is selected by default so that your images are displayed with the correct orientation even in viewers that do not support metadata for image rotation.

The following figure shows a rotated image:

The black areas represent the parts of the image that do not contain data values. In MrSID Generation 4 images, the no-data values are stored in the alpha band. For more information on alpha bands, see Alpha bands and MrSID on page 30.

Multispectral input images and the RGB transform

If no colorspace is specified, GeoExpress sets the output colorspace to match that of the source image (the equivalent of using the `-colorspace` switch with a value of `same`). Also by default, the RGB color transform (also known as the YIQ transform) is not used when creating multispectral images.

To apply the RGB color transform, enter `-colortransform TRUE`.

The default behavior is overridden if the input image is a multispectral image that has previously been encoded with the RGB color transform and the colorspace is still `same` (whether by default or by explicit setting). In this case, GeoExpress performs the RGB transform. That is, the output is a multispectral image with the YIQ color transform performed on the red, green and blue bands.

However, if in the above scenario the colorspace is changed to `multispectral`, the default behavior for multispectral images prevails. In this case the output is a regular multispectral image with no color transform performed.

Setting per-band compression ratios

For MG4 output you can specify compression ratios for individual bands using the `-perbandgroupcompressionratio` or `-pbgcr` switch. Specify a comma-separated list of `<bandgroup>@<ratio>`, where `<bandgroup>` is:

- a comma-separated list of bands (`'1,2,3'`), or
- a range of adjacent bands (in order) indicated by a colon (`'1:3'`), or
- the default group consisting of all unspecified bands (`'REMAINDER'`)

and `<ratio>` is:

- a positive integer indicating the desired desired lossy compression ratio (`'20'` means use a compression ration of 20:1), or
- `'L'` to indicate lossless compression

Default: `'REMAINDER@L'` (all bands for a multispectral compression are losslessly encoded).

Examples

- `'1:3@20'` and `'1,2,3@20'` are equivalent: compress the first three bands at 20:1 and everything else losslessly.
- `'1:3@20, REMAINDER@50'`: compress the first three bands at 20:1 and all other non-alpha bands at 50:1. The alpha band is always encoded losslessly.
- `'1:3@L, REMAINDER@50'`: compress the first three bands losslessly and all other non-alpha bands at 50:1. The alpha band is always encoded losslessly.

> **NOTE:** If you use the `-perbandgroupcompressionratio` switch and also specify `-colortransform TRUE`, then bands 1, 2 and 3 in the output file must all have the same compression ratio.

Lossless encoding

GeoExpress offers the ability to encode losslessly, which preserves all of the pixel data of the original source image. The resulting MG3, MG4 or JPEG 2000 image will be about half the size of the uncompressed size of the source image. To encode an image losslessly, specify the `-lossless` switch.

Example

The command

```
mrsidgeoencoder -i foo.tif -o foo.sid -of mg4 -lossless
```

creates a lossless MG4 file called `foo.sid`.

> **NOTE:** Multispectral images are encoded losslessly by default.

Watermarks

You can create images with custom watermarks. GeoExpress supports black and white watermark images in BMP, PNG, and JPEG formats. The watermark repeats across the entire image.

The following figure shows an example of a watermarked image:

NOTE: In versions of GeoExpress before v9.5.3, watermark images were limited to 128 × 128 pixels in size. Watermarks must be no wider and no taller than the output image.

Creating a test image

For raster images, you can create test images to test an image manipulation or compression operation without using data from the data cartridge. Test images are output images that have a visible watermark.

You can create test images from raster images and mosaics, but not LiDAR point clouds.

As an example, in order to create a test encode of the image `foo.tiff`, you would use the following syntax:

```
mrsidgeoencoder -i foo.tiff -testencode -o foo.sid
```

You can use the test encode function in combination with any other encode settings such as mosaic, compression ratio, cropping, etc.

Cropping an image

GeoExpress can encode a defined (cropped) region from any image whether it is a single image, an image mosaic, or an individual image inside a mosaic. With the proper switches set you can target an area to crop on encode by specifying geographic coordinate pairs; by specifying a center geographic coordinate and width and height; or by specifying the same options using image pixel values. You can combine image cropping with any encoding function such as updating images, creating mosaics, optimizing using higher compression, resampling, etc. Cropping via command line also means that you can batch process crop functions for a highly automated image production system.

This feature allows you to encode a subsection of an image without first having to export the subsection to a separate file. It also is useful for removing transparency areas of an image before encoding. By cropping away the edges containing transparency, the MrSID image, in some instances, can be made without encoding any background color into the output image.

> **NOTE:** The default for DOQ images is to automatically crop to Primary Corner Crosses to achieve a seamless mosaic.

When an image is cropped, the following attributes of the image are changed:
- width of the output MrSID image = input width (left pixel offset + right pixel offset)
- height of the output MrSID image = input height (top pixel offset + bottom pixel offset)
- file size = (input file size × width of the output MrSID image × height of the output MrSID image) / (input height × input width)

Using a text file for cropping

To crop multiple images, you may want to use a text file to list files and cropping values. The text file must have a `.mos` extension.

For example, if you want to crop three images to remove 10 pixels from the top, 20 pixels from the left, 30 pixels from the bottom, and 40 pixels from the right, you might write the following text file:

```
foo1.tif 10 20 30 40
foo2.tif 10 20 30 40
foo3.tif 10 20 30 40
```

To run the cropping job, use the following syntax:

```
mrsidgeoencoder -i mycrop.mos -tiff -cmos -o mycropped.sid
```

Like other text file lists supported by GeoExpress, similar rules apply to cropping:
- All four cropping values must exist for each file, even if no cropping is desired (e.g. 0 0 0 0).
- Only one file per line.
- Cropping values must be in top, left, bottom, right order.
- Cropping values must be positive integers.

Cropping by Vector Overlay

To crop an image with a vector overlay file, use the `-cropvectoroverlay` and `-cropvectorlayer` switches.

The `-cropvectoroverlay` switch specifies the name of the vector overlay file. The `-cropvectorlayer` switch specifies which layer to use. Layers are zero-based (0 is the first layer, 1 is the second, etc.). If a layer isn't specified, layer 0 is used by default. For example:

```
mrsidgeoencoder -i foo.tif -o foo.sid -cropvo overlay.xml -cropvol 0
```

When the image is encoded, the output file will have the dimensions of the smallest rectangle that contains the shape, and the areas outside of the shape will be filled in with black.

> **NOTE:** Vector overlays with multiple polygons are not supported. If you have a vector overlay that has multiple polygons you can use your favorite GIS package to extract a single polygon to a new vector overlay and then import the new vector overlay into GeoExpress.

Cropping Switches

SWITCH	VALUE	NOTES
`-croppedmosaic / -cmos`		The number of pixels to crop from the top, right, bottom, and left sides of the image.
`-coordspace / -coord`	string	Sets the coordinate system for cropping to image or geo. Default is image (pixels).
`-cropbottom`	float	Specifies crop region offset from bottom.
`-cropcxy`	float0 float1	Specifies center XY position of a cropping rectangle.
`-cropleft`	float	Specifies crop region offset from left.
`-croplrxy`	float0 float1	Specifies lower right XY position of a cropping rectangle.
`-cropright`	float	Specifies crop region offset from right.
`-croptop`	float	Specifies crop region offset from top.
`-cropulxy`	float0 float1	Specifies upper left XY position of a cropping rectangle.
`-cropvectorlayer / -cropvol`	sint	Specifies which layer in the file is to be used for cropping.
`-cropvectoroverlay / -cropvo`	string	Specifies the overlay file to be used for cropping.
`-cropwh`	float0 float1	Specifies width and height of a cropping rectangle.

Generating Esri AUX files

AUX files are used in older Esri products in the ArcGIS suite to specify coordinate reference system information. They have the extension `.aux`. You may want to generate Esri AUX files if your imagery will be used in Esri ArcGIS 9.1 or earlier.

To generate Esri AUX files, use the `-eaux` switch while encoding an image. For example:

```
mrsidgeoencoder -i foo.tif -o foo.sid -eaux
```

By default Esri AUX files are not generated.

Locking a file with a password

MG2 and MG3 support protecting output files so that a user must supply a password in order to decode or view them. (MG4 and JP2 do not support passwords.)

The `-password` or `-pw` switch accepts a password string that must not contain any spaces. For example:

```
-pw jpx678
```

creates a file with an access password of **jpx678**.

> **NOTES**
> - GeoExpress does not allow password-protected files to be used as input.
> - Only image data is encrypted; geocoordinates and other metadata are still accessible in password-protected files.

Optimizing MG3 and MG4 files

Optimizing is a way of repurposing an image without having to reencode it. Optimize is MrSID-specific and offers special options for existing MG3 and MG4 files. Any MG3 or MG4 image can be optimized unless it was encoded with the `-nonoptimizable` switch. In additional to flat files, MrSID composite images can also optimized.

Optimizing operations do not decrement the data cartridge.

Optimizing operations include cropping and resampling (or downsampling).

For information on cropping, see Cropping an image on page 19.

Resampling

The switch `-resample (sint)` resamples an MG3 or MG4 file by a power of 2.

MG3 and MG4 files are crafted to include multiple resolutions to allow rapidly zooming in and out by factors of two (i.e., 2x, 4x, etc.)

Resampling allows you to reduce the file size by limiting the number of zoom levels included in the output file, at the expense of lower detail.

The number of zoom levels to remove is mapped to a "resampling factor." For example, a resampling factor of two would remove one level and contain half as much detail as the original image. A resampling factor of four would remove two levels and contain one fourth of the detail of the original image.

Creating world files

By default, GeoExpress does not create accompanying world files for the images that it encodes. To create a world file at encode time, use the `-worldfile` switch.

For more information, see World files on page 42.

Creating and viewing logs

The GeoExpress log file is a description of recently completed encoding projects. It displays the encoding results for all of the jobs in the session including single file encodes, mosaics, updates and optimizations. The output log file is a simple text file that can be viewed with your favorite text editor/viewer.

You can generate a log file to document your encoding jobs by using the `-log` switch, followed by an output file name. For example:

```
-log mylogfile.txt
```

This log will be created in the directory from which you run the command.

If the log file already exists, new encode jobs are appended to it.

For example, this command creates or adds to a log file named `testlog.txt` in the directory `E:\Data`:

```
mrsidgeoencoder -i E:\Data\localTestImages\Images\MG4test_1.sid -o
    E:\Data\localTestImages\Images\MG4test_2.sid -resample 2 -log testlog.txt
```

Following is a sample entry in the GeoExpress log file:

```
Input file name: E:\Data\localTestImages\Images\MG4test_1.sid
Output file name: E:\Data\localTestImages\Images\MG4test_2.sid
Output format: MrSID Generation 4
Encoder version: 10.0.0.1234
Encode start time: Wed Apr 4 09:18:10 2018
Encode finish time:  Wed Apr 4 09:18:15 2018
Total encode time: 5 seconds
Input image size: 60.7 MB (63673750 bytes)
Output file size: 2.4 MB (2549678 bytes)
Target encode ratio: 20.00:1
Actual encode ratio: 24.97:1
Data Cartridge not decremented
```

Chapter 4: Advanced Encoding and Tools
Advanced encoding options
Overview

This chapter includes information on advanced operations such as encoding composite and mosaicked images, reprojection, Area of Interest encoding, and creating JPEG 2000 and NITF images. Information about the switches used in these operations is included here.

For information about lossless encoding, image cropping, creating a test encode and other single-image encoding and optimizing operations, see Encoding on page 13.

> NOTE: All switches are case-sensitive.

General MrSID advanced options

The following table describes switches for advanced encoding options in MrSID. For JPEG 2000 switches, see JPEG 2000 encoding on page 58.

SWITCH	VALUE	NOTES
-blocksize / -bs	sint	For MG3 and MG4 encoding, increasing block size may improve the lossless compression ratio, but at a possible cost of decreased quality in the compressed images. Decreasing this value may result in longer encoding times. Acceptable values: 5-64. Default: 64. For MG2 encoding, gigabyte-sized jobs should use a value of 1024, while larger jobs should use a value of 2048. Minimum value is 32. Default: 512. > IMPORTANT: Block size affects the use of system resources.

-multiresample	string	Sets the resampling method for a multiresolution mosaic. Accepted values are:
		    nearest: nearest neighbor resampling
		    bilinear: bilinear resampling
		    bicubic: bicubic resampling
		Default is nearest.

-numThreads	int	The number of threads that you want to use for the encoding operation. See Concurrency on the next page **Note:** In previous releases of this documentation this switch was incorrectly listed as numthreads; the switch is case-sensitive and must be entered as numThreads.
-tpc	string	Specifies transparency (nodata) color. Takes a comma separated list (see below). Used with MG2, MG3 and JPEG 2000. For transparency options in MG4, use the -alphasource (or -as) switch.

SWITCH	VALUE	NOTES
`-weight`	float	MG2 and MG3 only. A higher setting increases the emphasis on the grayscale aspect of a color image, while a lower setting increases the consistency of color between the compressed image and the original data. Acceptable values: 0.0-10.0. Default: 2.0.

Setting the transparency (No-Data) color

In MG4, transparency is handled through the alpha channel (Learn more). For all other output formats, use the `-tpc` switch. This switch takes a list in the form `<bandlist>@<color>` where `<bandlist>` is a comma separated list of the band numbers or a range of bands, and the color is a color value.

For example, to specify zero as the color value for bands one through five enter the following:

    1:5@0

To specify zero as the color value for all bands, enter the following:

    REMAINDER@0

To specify 127 as the color value for the first band and 1 for the color value for all remaining bands, enter the following:

    1@127, REMAINDER@1

For 8- and 16-bit RGB and grayscale images a transparency color can also be specified in RRR_GGG_BBB format. For more information on acceptable values, see Setting transparency metadata on page 52.

Concurrency

If you run GeoExpress on a computer multiple processor cores, GeoExpress creates multiple threads to process jobs more quickly. By default, GeoExpress uses the maximum number of threads available for optimal performance. The maximum number of threads equals the number of cores in your processor.

If you reduce the number of total threads, GeoExpress uses fewer cores. Reduce the number of total threads when you want to perform other processor-intensive tasks on the system that runs GeoExpress.

MG2-specific advanced options

SWITCH	VALUE	NOTES
`-gamma`	float	Changing the gamma value will affect the visual emphasis given to edges and flat color areas of the image. A lower setting creates more defined edges, while a higher setting creates softer edges. Acceptable values: 0.0-10.0. Default: 2.0.
`-imageenhancement`		Applies a dithering algorithm which may improve the visual quality of photographic imagery.

`-statistics / -stats`		Collects basic numeric statistics about the image's samples. Data collected includes the minimum, maximum, mean, and standard deviation of the samples for each band. The metadata tags that are added to the output file are:
		`IMAGE::STATISTICS:MAX`
		`IMAGE::STATISTICS:MEAN`
		`IMAGE::STATISTICS:MIN`
		`IMAGE::STATISTICS:STANDARD_DEVIATION`

MG3-specific advanced options

SWITCH	VALUE	NOTES
`-kweight`	float	Affects emphasis of the K band for CMYK images. A higher setting increases emphasis, while a lower setting increases the consistency of color between the compressed image and the original data. Acceptable values: 0.0-10.0. Default: 0.25.
`-onepass`		Specifies the use of the one-pass optimizer instead of the two-pass optimizer.

MG3- and MG4-specific advanced options

SWITCH	VALUE	NOTES
`-frequencybalance`	float	Affects the visual emphasis given to edges and flat color areas of the image. A lower setting creates more defined edges, while a higher setting creates softer edges. Acceptable values: 0.0-10.0. Default: 2.0.
`-kweight`	float	Affects emphasis of the K band. A higher setting increases emphasis, while a lower setting increases the consistency of color between the compressed image and the original data. Acceptable values: 0.0-10.0. Default: 0.25.
`-nonoptimizable`		Specifies that the target MrSID file cannot be optimized at a later date.
`-sharpness`	float	Increasing this value increases the accuracy of rendering for sharp boundaries between different areas of an image, and reduces ringing at such boundaries. Acceptable values: 0.0-1.0. Default: 0.0.
`-stripheight / -sh`	sint	MG3 and JP2 only. Affects memory usage. Increasing this value may improve runtime performance, but at a cost of requiring more physical memory. This value should be decreased when encoding very large images. Changing the strip height does not affect the quality of the output image. Acceptable values: Even integers from 2 to the image's height. Default: 64.

MG4-specific advanced options

SWITCH	VALUE	NOTES
`-colortransform`	boolean	Specifies that RGB (YIQ) Color Transform should be applied to first three bands in a multispectral image. Set to True only if first three bands are R, G and B in that order. Default: False.

SWITCH	VALUE	NOTES

`-alphasource / -as`		Specifies what value(s) to use as transparency (nodata) in generating the alpha channel. Accepted values are:
		    `opaque`: All input pixels are valid
		    `auto`: Use the nodata value if it is set, otherwise all pixels are valid
		    `<value>`: See Alpha bands and MrSID on page 30 for information on specifying per-band values

`-dynamicrange / -dr`	string	Calculate dynamic range information from the image statistics and write the dynamic range to the metadata. For acceptable values, see Generating dynamic range metadata on page 53.
`-floatingPointQuantizationPrecision / -fpqp`	string	For floating point images, you can specify a quantization precision value to ensure that image data is accurate to a specific value. Enter a comma-separated list of band numbers and precision values. For more information, see Floating point images on page 31.
`-floatingPointQuantizationMin / -fpqmin`	string	For floating point images, you can specify the minimum value that you want GeoExpress to keep during quantization. Enter a comma-separated list of band numbers and minimum values. For more information, see Floating point images on page 31.
`-floatingPointQuantizationMax / -fpqmax`	string	For floating point images, you can specify the maximum value that you want GeoExpress to keep during quantization. Enter a comma-separated list of band numbers and maximum values. For more information, see Floating point images on page 31.

Creating color composite images

GeoExpress allows you to combine up to 3 single-band images to form a color composite. You can assign to each image one of three color band assignments: red, green or blue. This is useful when working with NITF (National Image Transmission Format) files that can be segregated into separate color files.

For JPEG 2000 images, see Creating multiband JPEG 2000 files on page 65.

There are three command line switches that control the composite:

    `-redband`: specifies the red band component of a color composite input image file

    `-blueband`: specifies the blue band component of a color composite input image file

    `-greenband`: specifies the green band component of a color composite input image file

> **NOTE:** This is the only encoding operation that does not require the `-i` switch for an input file. The `-i` switch cannot be used in a color composite operation.

Files comprising a composite operation have the following restrictions:

- they must be single band images
- they must have the same bit depth characteristics
- they must be the same image size and geographic coordinate space if applicable

For example, to create a single RGB composite image using the images
```
red.ntf
blue.ntf
green.ntf
```
you would use the following command:
```
mrsidgeoencoder -redband red.ntf -blueband blue.ntf -greenband green.ntf -o
    mycomposite.sid
```

Despeckling an image

A side effect of lossy encoding schemes is that subtle compression artifacts are introduced which alter the pixel values of the source image. While these changes are usually invisible to the human eye, they can damage the integrity of any collar regions in the image, which makes it difficult to seamlessly mosaic images together.

The best way to avoid this "speckling" in the collar areas is to compress to MrSID Generation 4, or to losslessly encode source images to MrSID Generation 3 or JPEG 2000. If you need to make images with higher compression ratios, GeoExpress offers a despeckling option to minimize the compression effects in the areas that should be transparent.

Despeckling is a computationally expensive operation that increases the time it takes to encode an image. Also, despeckled JPEG 2000 files employ an alpha band to mask the transparent region; most, but not all, applications can view JPEG 2000 files with alpha bands.

Despeckling is only supported for MG3, MG4 and JPEG 2000 output. If you select JPEG 2000 as the format of your despeckled output, that output will be a GMLJP2 file and thus a JPEG 2000 Part II file, even if your input was a JPEG 2000 Part I file. Source images with alpha bands cannot be despeckled when outputting to JPEG 2000. Also, the area of valid image data must be contained within a single polygon (for example, an image of a series of islands cannot be despeckled).

There are two ways to despeckle imagery in GeoExpress: despeckling upon encoding and despeckling existing MrSID and JPEG 2000 images.

To encode a new image that's speckle-free, use the `-despeckle` switch with a value of `true`. For example:
```
mrsidgeoencoder -i foo.tif -o foo.sid -of mg4 -despeckle true
```

By default this value is `false` and images are not despeckled upon encoding. Further, despeckling is not recommended for images without a collar.

Despeckling existing imagery

To despeckle existing MG3, MG4 and JPEG 2000 images without re-encoding, use the `-despeckleonly` switch. For example:
```
mrsidgeoencoder -i foo.sid -o foo2.sid -despeckleonly
```

> **NOTE:** If you use this switch, you cannot specify any other encoding options except for tile length markers (`-tlm` / `-tilelengthmarkers`; specify zero to disable), packet length markers (`-plt` / `-packetlengthmarkers` or `-noplt` / `-nopltmarkers`), and tile parts (`-tp` / `-tileparts`; specify N to disable). For more information see JPEG 2000 encoding on page 58.

Setting despeckling options

If you require finer control over how despeckling is performed, you can set despeckling threshold and point spacing values.

To set despeckling threshold and point spacing values, specify a threshold value with the `-dsthreshold` switch. For example:

```
mrsidgeoencoder -i foo.tif -o foo.sid -of mg3 -ds true -dsthreshold 10
```

Specify point spacing using the `-dsspacing` switch, which takes an integer value greater than zero. For example:

```
mrsidgeoencoder -i foo.tif -o foo.sid -ds true -dsspacing 8
```

Despeckling threshold

All pixel values below the despeckling threshold will be used in the despeckling process. For example, with a threshold value of 10, GeoExpress treats any border pixels with a value less than 10 as no-data pixels.

If the `-despeckle` switch is set to `true` but no despeckling threshold value is specified, the default value is 8.

Point spacing

In order to despeckle an image, GeoExpress must determine the mask or "outline" of the valid image data. This outline is created as a polygon of connected points, similar to a "connect the dots" drawing. Image data that fall outside the outline are treated as invalid and subject to despeckling.

Whether image pixels are incorporated into the mask or abandoned as "islands" of data is largely a function of the point spacing value, which determines the distance between the points that make up the outline. The less distance there is between points in the outline, the more points it takes to create the entire outline.

Therefore, decreasing the point spacing value raises the number of points, which is generally desirable and is particularly useful when the outline is complex, such as that of a coastline. However, higher numbers of points may slow performance or cause the job to fail. Conversely, increasing the point spacing value reduces the total number of points, which makes for better performance. When the outline is simple, such as a rectangle, the point spacing value can safely be increased.

For any given dataset, some trial and adjustment may be required to arrive at the best balance between a more accurate mask (lower point spacing value) and better encode performance (higher point spacing value).

Generally, even values between 6 and 12 work best.

If the `-despeckle` switch is set to `true` but no point spacing value is specified, the default value is 6.

Demosaicking an image

GeoExpress enables you to "tile out" an existing MrSID or JPEG 2000 image into a number of smaller output tiles, including GeoTIFF images. The operation is called **demosaicking** because its result is the opposite of the result of the mosaicking process. However, the input image for a demosaicking operation does not have to be the result of any previous mosaicking.

To demosaic an existing MrSID or JPEG 2000 file, use the `-outputtilegrid` switch with the number of rows and columns that you wish to split the image into. For example:

```
mrsidgeoencoder -i foo.sid -o foo2.sid -outputtilegrid 2 3
```

This example splits the source image into two rows and three columns. The result will be 12 new image tiles. For information about the name and position of each tile, see Output tiling and file names on the next page.

If you define a crop region—either via a vector overlay or by setting crop commands—the grid pertains only to the crop region. By default the crop region is the entire image. (See Cropping an image on page 19 for details on defining a crop region.)

Output tile magnification

The -outputtilemag switch enables you to set the magnification or **scale** of the output tiles. A magnification of 1.0 represents the image at full scale, while a magnification of 0.5 reduces the output dimensions by half.

For example, if your input image measures 1000 × 1200 pixels and you set the output tiling to 2 rows, 2 columns and a magnification of 1, the result would be four tiles that measure 500 × 600 pixels each.

```
mrsidgeoencoder -i foo.sid -o foo2.sid -otg 2 2 -outputtilemag 1
```

If on the same 1000 × 1200 pixel image you set the output tiling to 2 rows, 2 columns and a magnification of 0.5, the result would be four tiles that measure 250 × 300 pixels each, half the size they would be at full magnification.

```
mrsidgeoencoder -i foo.sid -o foo2.sid -otg 2 2 -otm 0.5
```

Allowed values are fractional numbers greater than zero and less than or equal to 1. The default magnification value is 1.

Output tiling and file names

The name of each output tile will have the row and column value (starting at zero) appended to the base output name as follows:

```
<base name>_<row>_<column>.<file extension>
```

For example, if you specify 2 rows and 3 columns and a base file name of novato.sid, then the resulting output files will be named and positioned as follows:

```
novato_0_0.sid (row 0, column 0)
novato_0_1.sid (row 0, column 1)
novato_0_2.sid (row 0, column 2)
novato_1_0.sid (row 1, column 0)
novato_1_1.sid (row 1, column 1)
novato_1_2.sid (row 1, column 2)
```

Alpha bands and MrSID

All images encoded to MrSID Generation 4 (MG4) have an alpha channel or alpha band. If one is present, GeoExpress uses the alpha band in the input image. If no alpha band is present in the input image, then GeoExpress creates one.

The alpha band is always encoded losslessly, even if the rest of the image undergoes lossy compression.

MG2 and MG3 do not support alpha channels, but the transparency information in the alpha band of your source image is still preserved when encoding to MG2 and MG3. The alpha band will first be applied to the source image and then discarded from the output file.

Selecting a method for alpha band generation

To specify what method GeoExpress should use to create the alpha band, use the `-alphasource` switch. Acceptable values are:

- `opaque`: Specifies that all pixels should be treated as valid image data.
- `auto`: Specifies that GeoExpress should query the image metadata for the transparency values and treat all pixels with matching band color values as transparent. This is the default method.
- `<value>`: Specifies a transparency value for each band. GeoExpress treats as transparent all pixels whose band color values match the specified values. This value can take a number of forms:
    - For 8- and 16-bit RGB and grayscale images a transparency color can be specified in RRR_GGG_ BBB format.
    - For multispectral images, the values can be specified by a list in the form `<bandlist>@<color>` where `<bandlist>` is a comma separated list of
        - indices, or
        - ranges denoted by a colon (:), or
        - all unspecified bands denoted by REMAINDER (if not specified, `REMAINDER@0` is assumed)
      and `<color>` is a non-negative integral color value.

Examples

```
1:5@0,6:8@255
REMAINDER@0
1:255@0
1@127, REMAINDER@1
```

For more examples and information on acceptable values, see

> NOTE: For users of GeoExpress Standard Edition, the encoding of the alpha band does not additionally decrement your data cartridge. Your encode job will be metered the same with or without alpha bands.

Multispectral images and the RGB color transform

By default GeoExpress sets the output colorspace to match that of the source image.

In GeoExpress 10, the RGB color transform (also known as the YIQ transform) is used when creating multispectral images. In previous versions, the RGB color transform was not used by default.

Floating point images

When you compress a floating point image, GeoExpress uses quantization to compress the image. You can create 32-bit floating point images in the MrSID Generation 4 format.

Quantization is a lossy compression method that reduces the number of pixel values in the image. Quantization is necessary for floating point images for two reasons:

- Performing arithmetic on floating point values results in rounding discrepancies.
- Compressing floating point values results in unnecessarily large images. This is because some of the digits in each pixel value contain data that is not significant and cannot be compressed.

As a result, GeoExpress uses a lossy compression method for floating point images, but guarantees the accuracy of the image data to an optimized precision value.

Floating point quantization precision

When you compress a floating point image, GeoExpress automatically calculates the optimized precision value to use for quantization. You can also manually specify a precision value.

The pixel values of the compressed output image are accurate to within half of the precision value. For example, there is a pixel in your floating point image that has a value of 3000. If you specify a precision value of 0.5, then the same pixel after quantization will have a value between 2999.75 and 3000.25.

As a rule of thumb, you can calculate the optimized precision value used by GeoExpress with the following formula:

```
Precision = (Maximum value - Minimum value) / 216
```

Whether you manually specify a precision value or allow GeoExpress to automatically calculate a precision value, GeoExpress records the precision value used during quantization in the image metadata. The precision value for each image band is stored in the `IMAGE::QUANTIZATION_SCALE` metadata tag. The tag lists the precision value used for each band of the image, including the alpha band. The last value in the metadata tag is for the alpha band precision value.

> **TIP:** You can view the metadata of the output image with the command:
> ```
> mrsidgeoinfo -meta foo.sid
> ```

Setting a Precision Value

To specify a precision value, use the `-floatingPointQuantizationPrecision` or the shortened `-fpqp` switch. The precision value that you enter depends on the range of values in the input image.

You can specify one quantization precision value for all the bands in an image, or you can specify individual precision values for each band. To specify a precision value for each band, enter a comma-separated list of bands and precision values in the following format:

```
-fpqp <band1>@<precision1>,<band2>@<precision2>,...
```

Examples

```
mrsidgeoencoder -fpqp 0.5 -i f32_DEM.img -o f32_out.sid

mrsidgeoencoder -fpqp 1@0.5,2@0.7,3@0.5 -i f32_DEM.img -o f32_out.sid
```

Floating point quantization range

In addition to the quantization precision value, you can specify the range of values that you want GeoExpress to keep during quantization.

If the input image contains minimum or maximum values that are far removed from the rest of the pixel values, then you may want to manually specify minimum and maximum values. For example, if the input image contains a maximum value of 32,000, but does not contain any pixel values between 20,000 and 32,000, then you may want to specify a maximum value of 20,000. In this example, GeoExpress changes all pixel values greater than 20,000 to 20,000. If you manually constrain the quantization range, you can improve the appearance of images that have very little data near the minimum and maximum values.

To specify a range of values for quantization, use the `-floatingPointQuantizationMin` and `-floatingPointQuantizationMax` switches, or use the shortened `-fpqmin` and `-fpqmax` switches. You must specify both a minimum and maximum value.

You can specify one minimum and one maximum value for all the bands in an image, or you can specify individual values for each band. To specify values for each band, enter a comma-separated list of bands and values in the following format:

```
-fpqmin <band1>@<minimum1>,<band2>@<minimum2> -fqpmax
    <band1>@<maximum1>,<band2>@<maximum2>
```

Examples

```
mrsidgeoencoder -fpqmin 0 -fpqmax 33000 -i f32_DEM.img -o f32_out.sid

mrsidgeoencoder -fpqp 0.5 -fpqmin 0 -fpqmax 33000 -i f32_
    out.sid

mrsidgeoencoder -fpqmin 1@0,2@35,3@0 -fpqmax 1@33000,2@27000,3@29000 -i f32_
    DEM.img -o f32_out.sid
```

Floating point quantization and No-Data

Many floating point images denote no-data values as an arbitrary minimum value. For example, an image may use -9999 as the no-data value even though there aren't any pixel values between -9999 and 0.

Such large gaps in pixel values create an artificially wide dynamic range that may cause output images to appear dark. For more information on dynamic range, see Generating dynamic range metadata on page 53. To ensure that output images display correctly, ensure that the no-data value is specified in the metadata before you compress the image. If the no-data value is not in the metadata, you can manually specify the no-data value with the -alphasource switch.

For more information on specifying no-data values, see Alpha bands and MrSID on page 30.

Encoding Areas of Interest

GeoExpress enables you to define Areas of Interest in MG3, MG4 and JPEG 2000 encoding. Vector overlay support enables you to include multiple Areas of Interest within a single image.

What Is an Area of Interest?

The Area of Interest (AOI) encoding feature is a tool that enables image customization through the preservation or obscuring of detail. AOI enables you to define one or more areas within an image or mosaic and encode these areas at a higher or lower compression ratio than the remainder of the image. Using AOI thus creates a visual contrast between the area(s) of interest and the surrounding image, rendering either "sharper" areas (lower compression) or "blurred" areas (higher compression).

In the image below we've drawn a rectangle around an area that has been defined as an Area of Interest and compressed at a lower ratio than the rest of the image. Note that greater detail is preserved within that area.

GeoExpress enables you to encode an Area of Interest in in MG3, MG4 or JPEG 2000 format.

Inner and Outer areas

All regions inside specified Areas of Interest are called "foreground". All surrounding regions are called "background". "Inner" and "outer" correspond to foreground and background respectively.

In JP2 encoding, the `-aoishiftinner` and `-aoiweightinner` switches preserve the quality of the foreground at the expense of the surrounding regions. Similarly, the `-aoishiftouter` and the `-aoiweightouter` switches preserve the quality of the background at the expense of the foreground.

In MG3 encoding, inner and outer are not specifically referred to except when using the mask method. The foreground and background are controlled using the `-aoicr` or the `-aoilossless` switch. If the value specified with the `-aoicr` switch is less than the value for the image's overall compression ratio as specified by the `-cr` switch, then the foreground will be preserved at a greater quality than the background. If the `-aoicr` value is greater than the `-cr` value, then the background will be preserved at a greater quality than the foreground.

In the mask method, the `-aoimaskinner` switch renders the foreground as a solid color and the `-aoimaskouter` switch similarly affects the background.

Reading the log file

The compression ratios for the inside and outside of the Area of Interest are reported in the GeoExpress log file, along with the overall encode ratio for the entire image.

Using Area of Interest with image crop

GeoExpress accommodates a workflow that demands a number of image customizations at a single encode. Accordingly, you can define a crop region and an Area of Interest for the same encoding event. Also, you can specify an Area of Interest anywhere in the image, regardless of whether or not it is in the crop region. Obviously, any portion of an Area of Interest that falls outside the crop region will be lost on encode.

Notes

Although Area of Interest is a simple concept, there are many factors that come into play when generating both the preview and the final encoded image in an Area of Interest operation. Some of these factors are:

- the relative size of the selected area in relation to the entire image
- the difference between the two compression ratios applied—inside and outside the selected area
- the presence or addition of a crop operation in conjunction with an Area of Interest encode
- desired output format—MG3, MG4, or JP2
- the complexity of the imagery being manipulated

Some of the effects that a user may experience as a result of these factors are:

- slight bleeding of the AOI resolution into the surrounding image
- "outside" area seems less compressed than expected given the specified compression ratios
- Area of Interest specified as lossless is not always numerically lossless for some encode scenarios (this variation is greater in JPEG 2000 encoding than in MrSID encoding).

Specifying an Area of Interest

You may specify an Area of Interest either by defining a rectangle or by using a vector overlay file.

Defining a rectangle

Area of interest switches are listed and described in a table below. You can define a rectangle in several ways:

- specifying edge offset values
- specifying upper left and lower right values
- specifying upper left and width and height values
- specifying image center and width and height values

To specify edge offsets, use the `-aoitop`, `-aoibottom`, `-aoileft`, and `-aoiright` switches with floating point values (either pixels or geocoordinates; see Unit of measurement below). For example:

```
-aoitop 244 -aoibottom 300 -aoileft 16 -aoiright 447
```

To specify upper left and lower right values, use the `-aoiulxy` and `-aoilrxy` switches with floating point *x* and *y* values for each. For example:

```
-aoiulxy 30 84 -aoilrxy 451 515
```

To specify upper left, width, and height values, use the `-aoiulxy` and `-aoiwh` switches.

To specify center, width, and height values, use the `-aoicxy` and `-aoiwh` switches.

Unit of measurement

The unit of measurement for an Area of Interest can be either pixels or geocoordinates. Use the `-aoicoord` switch to change the measurement unit. Acceptable values:

- `image` (pixels)
- `geo` (geocoordinates)

The default measurement unit for an Area of Interest is pixels.

Using a vector overlay file

GeoExpress supports vector overlay files of Esri shapefile (`*.shp`), MapInfo (`*.tab`) and GML (`*.xml`) formats. To specify a vector overlay use the `-aoivectoroverlay` or the `-aoivo` switch with the name of the file. To specify which zero-based layer of a vector overlay file to use for an Area of Interest operation, use the `-aoivectorlayer` or the `-aoivol` switch. For example:

```
-aoivectoroverlay seattlesp_utm.shp -aoivol 3
```

By default, the first layer in the vector overlay file is used.

A Note on GFS files

The use of GML-formatted vector overlays can result in the creation of files with a `.gfs` extension in the directory on your computer where the GML files are stored. These are not used again and may be ignored or deleted.

Switches

Several switches are available on the command line for defining and encoding an Area of Interest. Many are common to both MrSID and JP2. Several are MrSID-only or JP2-only switches.

Common switches

The table below describes switches common to both MrSID and JP2.

The position switches are functionally identical to the corresponding cropping switches.

SWITCH	VALUE	NOTES
`-aoitop`	float	Specifies Area of Interest offset from top.
`-aoileft`	float	Specifies Area of Interest offset from left.
`-aoibottom`	float	Specifies Area of Interest offset from bottom.
`-aoiright`	float	Specifies Area of Interest offset from right.
`-aoiulxy`	float0 float1	Specifies upper left XY position of Area of Interest.
`-aoilrxy`	float0 float1	Specifies lower right XY position of Area of Interest.
`-aoicxy`	float0 float1	Specifies center XY position of Area of Interest.
`-aoiwh`	float0 float1	Specifies width and height of Area of Interest.
`-aoicoord`	string	Sets the coordinate system for Area of Interest to image or geo. Default: image.
`-aoimaskinner`		Drives the interior area to a single color value (defaults to black). Cannot be used with any other AOI method (`-aoicr`, `-aoilossless`, `-aoishiftinner`, `-aoishiftouter`, `-aoimaskouter`, `-aoiweightinner`, `-aoiweightouter`).
`-aoimaskouter`		Drives the exterior area to a single color value (defaults to black). Cannot be used with any other AOI method (`-aoicr`, `-aoilossless`, `-aoishiftinner`, `-aoishiftouter`, `-aoimaskouter`, `-aoiweightinner`, `-aoiweightouter`).
`-aoimaskcolor`	string	Optional switch used in conjunction with the `-aoimaskinner` and `-aoimaskouter` switches to specify the mask color. Acceptable values are: `black`: uses the minimum sample value `white`: uses the maximum sample value `<RRR_GGG_BBB>`: uses a custom 8-bit RGB color Default: `black`
`-aoivectoroverlay`	string	Short form: `-aoivo`. Specifies an Area of Interest using a vector overlay file.Supported vector overlay formats include: Esri shapefile (`*.shp`) MapInfo (`*.tab`) GML (`*.xml`)
`-aoivectorlayer / -aoivol`	sint	Specifies the zero-based layer within a vector overlay file to use for an Area of Interest operation. The default layer is the first layer in the file.

MrSID-specific switches

The table below describes switches available only for MG3 and MG4 formats. For more information see MG3 and MG4 Area of Interest encoding below.

SWITCH	VALUE	NOTES
`-aoicr`	float	Encodes Area of Interest with a specific compression ratio.
`-aoilossless`		Encodes Area of Interest losslessly.

JP2-specific switches

The table below describes JP2-only switches. For more information see JP2 Area of Interest encoding on the next page.

SWITCH	VALUE	NOTES
`-aoinumlevels`	uint	Determines the number of zoom levels that the Area of Interest encoding applies to. Defaults to all zoom levels.
`-aoishift`	uint	Used in conjunction with `-aoishiftinner` or `-aoishiftouter`. Sets an optional shift value to be used with either the "shift inner" or "shift outer" Area of Interest methods.
`-aoishiftinner`		Preserves quality in the interior Area of Interest.
`-aoishiftouter`		Preserves quality in the exterior Area of Interest.
`-aoiweightinner`	uint	Encodes the interior area with a given weight value.
`-aoiwieghtouter`	uint	Encodes the exterior area with a given weight value.

MG3 and MG4 Area of Interest encoding

GeoExpress offers two methods, the weight and mask methods, for encoding an Area of Interest with MG3 as the output format. For a table describing the Area of Interest encoding switches, see Specifying an Area of Interest on page 35.

> **NOTE:** Area of interest encoding in MrSID format automatically uses the 2-pass optimizer.

The weight method

The weight method is not to be confused with the "weight" parameter in the advanced encoding options. Also, Area of Interest encoding using the weight method functions differently for MrSID and JP2 output. In MrSID encoding the weight method requires the user to input a compression ratio for the Area of Interest. GeoExpress calculates the resultant image filesize as part of the encoding process, taking into account the user-defined compression ratios for inside and outside the Area of Interest (see Inner and Outer areas on page 34). These ratios are used in a calculation of the overall image compression. The actual output is reported on the GeoExpress log file. For more information, see Calculating MrSID Area of Interest weight on page 86.

To use the weight method, specify a compression ratio for the data inside the Area of Interest by using the `-aoicr` (or `-aoicrlossless`) switch. The outside area will be encoded at the compression ratio specified for the entire image (in the `-cr` switch).

The mask method

The mask method removes the foreground or the background (see Inner and Outer areas on page 34) and replaces it with a solid color. The mask method only applies to encode jobs and is not available for optimizations. To mask the foreground areas use the `-aoimaskinner` switch.

To mask the background areas use the -aoimaskouter switch. These switches cannot be used with any other AOI method (-aoicr, -aoilossless, -aoishiftinner, -aoishiftouter, -aoimaskouter, -aoiweightinner, -aoiweightouter).

Mask color

The default color for the masked areas is black. You may change this using the -aoimaskcolor switch in conjunction with either the -aoimaskinner or the -aoimaskouter switch.

Acceptable values for the -aoimaskcolor parameter are as follows:

>   black: uses the minimum sample value
>   white: uses the maximum sample value
>   <RRR_GGG_BBB>: uses a custom 8-bit RGB color

The default value is black.

JP2 Area of Interest encoding

GeoExpress offers three methods, the weight, shift and mask methods, for encoding an Area of Interest with JP2 (JPEG 2000) as the output format. For a table describing the Area of Interest encoding switches, see Specifying an Area of Interest on page 35.

The weight method

The weight method is not to be confused with the "weight" parameter in the advanced encoding options. Also, Area of Interest encoding using the weight method functions differently for MrSID and JP2 output. In JPEG 2000 encoding the weight value controls the image quality of the foreground relative to the background or vice versa (for more information see Inner and Outer areas on page 34).

Use the -aoiweightinner switch to preserve the quality of the foreground areas at the expense of the surrounding regions. Similarly, use the -aoiweightouter switch to preserve the quality of the background at the expense of the foreground. Both switches take an unsigned integer.

Acceptable values are 0–1000.

Larger values will result in a greater differences in quality between foreground and background, and smaller values will result in less of a marked difference. (**Note:** a value of 1.0 will have essentially no AOI weighting effect.)

When using the weight method, the actual boundaries of the region are defined by the extents of the codeblocks within each resolution level. Because the spatial extent of the codeblocks varies by level, the actual encoded region may appear larger than the selected region, and a step-like fall-off in quality may be noticeable.

For important additional information see Notes on AOI encoding and JPEG 2000 on the facing page.

The shift method

The shift method, like the weight method, favors either the "inner" or "outer" area.

The shift method is an alternative way to express the encoding of an Area of Interest when JPEG 2000 is specified as the output format. Rather than affecting the amount of quality in a codeblock at encode time, the shift mode adjusts the "importance" of individual pixels by the specified shift amount. In other words, this function promotes the importance (or sharpness) of the data inside or outside the Area of Interest (see Inner and Outer areas on page 34).

The shift value to be specified is the number of bit positions to "promote" the foreground region over and above the background. For 8-bit samples, an appropriate scaling factor would be 12. Images to be encoded with large bit-depths and/or a large number of levels may, under certain conditions, require a higher value.

Use the `-aoishift` switch to specify a value. Acceptable values are 1-20. Default shift when using the 5-3 wavelet is 5. Default shift value when using the 9-7 wavelet is 6. **Note:** If you use the `-aoishift` switch you must also use either the `-aoishiftinner`or the `-aoishiftouter` switch.

You may use the `-aoishiftinner` or `-aoishiftouter` switches without using the `-aoishift` switch. In this case, GeoExpress uses the default shift values noted above.

While the shift method does not suffer the stepping effects of the weight method, less granularity of control between foreground and background is afforded. The differences between the two methods are subtle and technical; we recommend that the weight method be used unless large quality differences are desired.

Although with practice and experimentation the shift mode can be used to completely mask out a desired region, its purpose is "obscuring" areas of an image rather than masking them out. It is recommended that you use the Mask method if you wish to achieve a masking effect (for more information see MG3 and MG4 Area of Interest encoding on page 37).

For important additional information see Notes on AOI encoding and JPEG 2000 below below.

The mask method

The mask method in JP2 is the same as in MrSID Area of Interest encoding. For information, see MG3 and MG4 Area of Interest encoding on page 37.

Number of AOI levels

The `-aoinumlevels` switch controls the number of resolution levels subject to the AOI encoder process in the shift and weight methods; this can be used to alleviate the "stepping" effect mentioned above. When number of levels is set to less than the total number of levels in the image, the lower-resolution levels will not undergo AOI processing; in this way, only the *n* highest resolutions are affected, so the icon image (and potentially other lower-resolutions) will appear as if no AOI had been selected.

By default all zoom levels are subject to the AOI encoder.

Notes on AOI encoding and JPEG 2000

When using the weight method for Area of Interest encoding with JPEG 2000, it is recommended that you use a smaller codeblock size, such as width = 32, height = 32. This parameter can be set with the `-codeblocksize` switch (for more information see Advanced encoding options on page 24).

The overall compression ratio chosen for the encode job can be as important to the appearance of the region as the actual weight or shift values chosen. The image quality at a given compression ratio may diverge dramatically from expected results when AOI encoding is enabled. Getting the desired effect in JP2 Area of Interest encoding may require a trial and revision process.

For more information on JPEG 2000 encoding, see JPEG 2000 encoding on page 58.

Reprojection
What is reprojection?

Reprojection is changing the projection of an image from one coordinate reference system (CRS, sometimes also called spatial reference systems or SRS) to another.

A coordinate reference system defines the location of a point on a planar or spherical surface. An example familiar to many people is a graph with *x* and *y* axes. A geographic coordinate system is a three-dimensional reference system that locates points on the Earth's surface based on projections. Projections are the method used to display a spherical surface onto a flat surface. In this manner, Cartesian coordinate systems can be overlaid.

Coordinate reference systems are prearranged projections used in specific countries either in modern times or in historical maps. However, many states and counties within a country may employ a different coordinate reference

system. These reference systems differ in order to maintain the highest accuracy in a smaller defined region. Because they are only approximations of the shape of the Earth—which is irregularly shaped—the larger an area a given coordinate system covers, the less accurate it will be.

An agency working on a broad area of coverage, such as statewide, will typically work in the UTM (Universal Transverse Mercator) system, since it can be used over larger geographic areas. Organizations whose Area of Interest covers a smaller geography, such as county or city level management, will typically work in a State Plane coordinate system. This presents problems when trying to employ data from different sources for use in a single project.

The reprojection tools in GeoExpress enable you to take images that are georeferenced in one or more coordinate reference systems, and reproject these images to a different coordinate reference system either individually or as a mosaic. CRSs are identified by regions of use, subregions and system names as defined by the European Petroleum Survey Group (EPSG). You can also use well-known text strings (WKTs).

You can repurpose and combine diverse data sets by using the GeoExpress reprojection tools when you create a new image or by reprojecting your existing images. With support for over 2,500 WKT (well-known text) coordinate systems such as State Plane Coordinate Systems and UTM—as well as hundreds of specific regional projections—GeoExpress enables geospatial professionals to share imagery across boundaries previously imposed by disparate coordinate reference systems.

As an example, say you have a shapefile using a coordinate reference system of Latitude/Longitude, WGS84, while the raw imagery you purchased from an image data provider is created in UTM, NAD83, Zone 18N. Using the reprojection feature in GeoExpress, you are able to reproject the raw imagery to the Lat-Long coordinate reference system while converting it to MG3, MG4 or JP2 format within your normal encoding workflow.

NAD 83/UTM
Zone 18N(26918)   Lat-Long WGS84
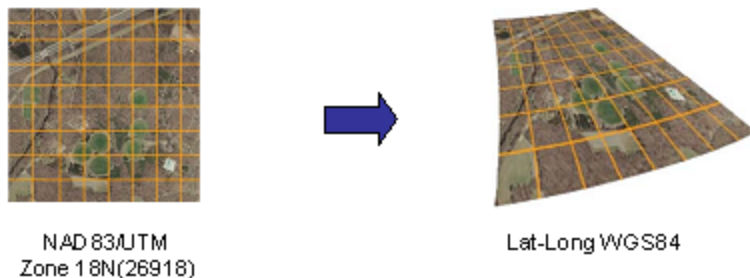
> **NOTE:** Reprojection necessarily involves encoding since pixel data cannot be altered in compressed wavelet space.

Reprojecting images

GeoExpress allows images to be reprojected from one coordinate reference system (CRS) to another. The output formats that support reprojection are MG3, MG4, JPEG 2000 (JP2) and NITF 2.1.

Both a source and an output CRS must be specified for a reprojection operation. You may enter any CRS defined by the European Petroleum Survey Group (EPSG). You can also enter a well-known text string (WKT) that describes the coordinate system.

> **NOTE:** If you create a mosaic from images in different projection systems, you do not need to specify an input coordinate reference system with the `-fromepsg` switch. For more information on mosaics with multiple projections, see Creating a mosaic on page 43.

The error fraction is a value from 0.0 to 1.0 that indicates the level of accuracy of the reprojection. A value of 0.0 is the highest level of accuracy—basically a "lossless" reprojection. An error fraction of 0.125 means that each

reprojected pixel could be off by an eighth of a pixel, while a value of 0.25 indicates the allowance of a quarter pixel inaccuracy.

Of the resampling methods, nearest neighbor is the fastest method, while bicubic gives more accurate results. Bilinear offers a compromise, faster than bicubic but more accurate than nearest neighbor.

Use the `-reprores` flag to change the *x* and *y* output resolution of the reprojected image. If you manually set the resolution and you notice that the image is offset, you may want to use the `-alignpixels` switch. For more information, see Encoding on page 13.

> NOTE: Reprojection is an encoding operation, meaning that compressed file formats such as MrSID and JPEG 2000 will be decompressed and re-encoded during the reprojection operation, which could result in a loss of image quality.

Example
```
mrsidgeoencoder -i foo.tif -o foo.sid -fromepsg 4326 -toepsg 26718
```

Reprojection switches

SWITCH	VALUE	NOTES
`-fromepsg`	sint	Specifies the EPSG code describing the input image's coordinate reference system.
`-fromwkt`	string	Specifies a text file containing a WKT that describes the input image's coordinate reference system.
`-toepsg`	sint	Specifies the EPSG code describing the output image's desired coordinate reference system.
`-towkt`	string	Specifies a text file containing a WKT that describes the output image's desired coordinate reference system.
`-reprores`	float0 float1	Specifies the *x* and *y* resolutions for a reprojected image. You may want to use this switch in conjunction with -alignpixels.
`-reproerror`	float	Specifies the desired error fraction for a reprojection operation. Acceptable values range from 0.0 to 1.0.
`-reproblocksize / -rbs`	sint	Sets the reprojection blocking value. Use smaller values for larger images. Default: 2048.

`-reproresample`	string	Sets the resampling method for a reprojection operation. Accepted values are:
		    `nearest`: nearest neighbor resampling
		    `bilinear`: bilinear resampling
		    `bicubic`: bicubic resampling
		Default: `nearest`

`-repronotempfile`		Specifies that GeoExpress should not use temp files for reprojection operations. By default temp files are used.

World files

A "world file" is a simple text file containing auxilliary georeferencing information for an image. It can be used to georeference an image that has no georeferencing information within it, or to override existing georeferencing information.

By convention, the filename for a world file is the same as the image it pertains to, with a different extension. The three-letter extension is made up of the first and last characters of the image filename extension, followed by a **w**. For example, the world file for a TIFF image named `bainbridge.tif` would be `bainbridge.tfw`; the world file for a MrSID image named `madison.sid` would be named `madison.sdw`.

Format

The world file format is six lines, each line containing a double precision value (represented in text). No additional lines may be present. Leading and trailing white space are allowed.

The meanings of the six values are:

1. dimension of a pixel in map units in *x* direction
2. first rotation term
3. second rotation term
4. dimension of a pixel in map units in *y* direction
5. *x*-coordinate of the center of the upper-left pixel
6. *y*-coordinate of the center of the upper-left pixel

The *y*-dimension is, by convention, a negative value.

GeoExpress ignores the rotation term in most cases.

Example

This is an example of a world file:

```
 0.20000000
 0.00000000
 0.00000000
-0.20000000
780.10000000
219.90000000
```

This world file indicates the image resolution is (0.2, -0.2) and the upper-left is at (780.1, 219.9). The rotation terms are zero, meaning no rotation is required.

Creating and working with mosaics

A mosaic is a group of images that you view as a single image. Each of the images that make up a mosaic is called a tile. There are two types of mosaics, flat mosaics and composite mosaics.

A flat mosaic is an image created from multiple input images. Flat mosaics are the most common type of mosaics. They do not preserve information about each input image and require compressing all the input images again. Flat mosaics can be created in the MrSID, JPEG 2000, and NITF formats. Creating a flat mosaic decrements the data cartridge. For more information, see Data cartridges on page 88.

To create a flat mosaic, see Creating a mosaic on the facing page.

A composite mosaic is a MrSID image that contains other MrSID images. Composite mosaics are a special type of mosaic that can only be created in the MrSID Generation 3 and MrSID Generation 4 formats. They can be created quickly because they do not need to be compressed again, but they may load more slowly than flat mosaics. Creating a composite mosaic is also known as updating a mosaic, and it does not decrement from the data cartridge. An MG4 composite can only contain MG4 files. An MG3 composite can contain MG3 and MG2

files. MG4 composites can contain tiles of differing resolutions. MG3 composite mosaics do not support tiles with different resolutions. MG3 composites can be updated with tiles of a different resolution but must subsequently be flattened.

To create a composite mosaic, see Creating a composite (MrSID) mosaic on page 45.

Creating a mosaic

To create mosaics in GeoExpress, create a mosaic text file, that is, a file with the `.mos` extension. Mosaic files list the images that you want to add to the mosaic, and can be used both for images that do and do not have georeferencing.

The individual input tiles of a mosaic cannot be cropped. The mosaic file can be given any name.

Images with georeferencing

For georeferenced images (TIFF images with `.tfw` files, JPEG images with `.jgw` files, BIL, BIP, or BSQ images with supported `.hdr` files, LAN, GeoTiff, ERDAS IMAGINE, USGS DOQ images or MrSID files), the text in the mosaic file lists the images that you want to add to the mosaic.

In the following example, a mosaic is created from four TIFF files. A sample mosaic file for this project is displayed below:

```
image_nw.tif
image_ne.tif
image_sw.tif
image_se.tif
```

The following command creates the mosaic using the mosaic file above:

```
mrsidgeoencoder -i mosaic.mos -mos -o mosaic.sid
```

The `-mos` switch identifies the input file as a mosaic file.

> **NOTE:** GeoExpress does not recognize mosaic files with spaces in either the listed file names or in the listed paths. In addition, the first line in the file cannot be blank and the last line in the file must be followed by a carriage return.

Displaying the tile boundaries

You can opt to generate a shapefile that includes the boundaries of each tile that makes up the output image. Include the switch `-writeboundsshapefile` (or `-wbshp`) in your command:

```
mrsidgeoencoder -i mosaic.mos -mos -o mosaic.sid -writeboundsshapefile
```

Your job will be created and include the file `mosaic.shp` (or whatever name you chose for your output file). You can then use a program such as GeoViewer to load the image and shapefile to see the tile boundaries overlaid on the output image.

Images without georeferencing

When creating a mosaic using images that lack georeferencing information, a mosaic file must be created. In this case, the mosaic file must list the file names and the upper left corner pixel location for each image. Each image must be listed based on the following format:

```
image_name x-pixel_location y-pixel_location
```

Only a single space is required between each of the three items in the list. Each image listed must be on a separate text line.

Base the upper left corner pixel location of each image on the location of the image relative to an x=0, y=0 pixel location of the upper left corner of the entire set of images.

Consider an example where a single image is being created from four separate scanned Sun Raster images, each 640 by 480 pixels in size.

The mosaic file requires the following four lines:

```
image_nw.ras 0 0
image_ne.ras 640 0
image_sw.ras 0 480
image_se.ras 640 480
```

The sample file above joins the specified images as follows:
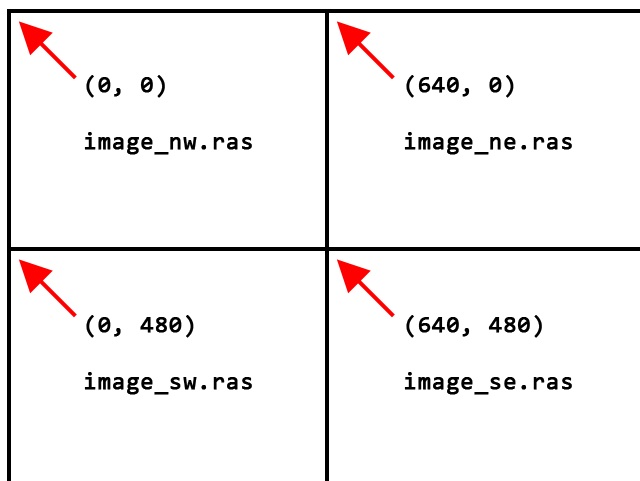
A positive *y* value places the image that many pixels from 0,0 in the negative *y* direction.

Multiresolution input

Use the `-multires` switch with the `-mos` switch to allow multiresolution input for a mosaic.

> **NOTE:** Only flat mosaics support tiles with different resolutions.

Mosaicking tiles from multiple projections

You can create a mosaic from tiles with different projection systems. Specify an output projection for the tiles using the `-toepsg` or `-towkt` switch. For more information on specifying an output projection, see Reprojecting images on page 40.

For example, you might enter the following command:

```
mrsidgeoencoder -i tiles.mos -mos -toepsg 4326 -o output.sid
```

When you create a mosaic from tiles with multiple projections, GeoExpress enables multiresolution input by default.

Encoding large flat mosaics

There are several things that you should understand and keep in mind when encoding large flat mosaics (for the difference between flat and composite mosaics, see Creating a mosaic on page 43):

1. Certain operations will increase encoding time, such as mosaicking and reprojecting, since they require decoding first, whereas others, such as cropping and recompression, can be done in compressed format and will not adversely affect encoding time. Working from RAW images will always be faster than working with compressed imagery.

2. Several configurable parameters you may wish to set will have an effect on the encoding time:

    -   strip height: selecting higher strip height will result in faster encoding while using more RAM; a lower value, such as 2, will result in a very long encode time but will use less memory.
    -   block size: block size has more of an effect on memory usage than strip height. Selecting a higher block size will use more RAM. Selecting a lower block size will result in lesser quality compression, although there is no benefit in setting it extremely high.

3. You can expect the following pixel-width limits for the following encoding settings on a computer with 2GB RAM:

    -   a strip height of 12 and block size of 64 will work on images up to 500,000 pixels in width
    -   a strip height of 12 and a block size of 32 should be used for images between 500,000 and 1 million pixels in width

4. Your workflow will be more efficient if you:

    -   encode to a lossless "master" first
    -   subsequently take any croppings or make compressions from the master mosaic

5. If possible avoid the strategy of making smaller mosaics first that will in turn be mosaicked in another encoding; this will only increase your encoding time. Even if you want smaller mosaics in addition to the full mosaic, it will take less time to create the full mosaic and crop than it will to create the small mosaics and then create a larger mosaic from those.

Creating a composite (MrSID) mosaic

GeoExpress provides the ability to create an MG3 or MG4 image composed of other images. Such an image is called a **composite mosaic**. (For more about the difference between flat mosaics and composites, see Creating a mosaic on page 43.)

An MG4 composite can only include MG4 images, but tiles can be different resolutions.

An MG3 composite can include MG3 and MG2 images, but all tiles must be the same resolution.

All images included in a composite mosaic must have the same color depth and be in the same colorspace.

Note that any included MG3 or MG4 image can itself be a composite mosaic; in this way you can add to or update an existing mosaic.

Creating the Mosaic

In order to create a composite mosaic, use the following syntax:

```
mrsidgeoencoder -i tiles.mos -o outputcomposite.sid -composite
```

The mosaic file (`tiles.mos` in the example) lists the images to be used to create the composite mosaic.

The command line switch `-composite` indicates that the output file should be a composite mosaic, not a flat mosaic.

In the following example, an image is created from four MrSID files.

A sample mosaic file (`fourcorners.mos`) for this project is displayed below:

```
image_nw.sid
image_ne.sid
image_sw.sid
image_se.sid
```

The following command creates the image using the mosaic file above:

```
mrsidgeoencoder -i fourcorners.mos -o compositemosaic.sid -composite
```

> **NOTE:** GeoExpress does not recognize mosaic files with spaces in either the listed file names or in the listed paths. In addition, the first line in the file cannot be blank and the last line in the file must be followed by a carriage return.

Displaying the Tile Boundaries

You can generate a shapefile that identifies the boundaries of each tile that makes up the mosaic. Include the switch `-writeboundsshapefile` (or `-wbshp`) in your command:

```
mrsidgeoencoder -i fourcorners.mos -mos -o compositemosaic.sid -composite
    -writeboundsshapefile
```

Your job will be created and include the file `compositemosaic.shp` (or whatever name you chose for your output file). You can then use a program such as GeoViewer to load the image and shapefile to see the tile boundaries overlaid on the output file.

Mosaics with overlapping input

When images are geographically rectified to align accurately with a fixed point (such as magnetic North), the image may appear tilted. Such an image has triangles of transparency along all four edges, as in the following illustration:

When multiple tilted images are seamed together in a mosaic, these transparency triangles often obscure data from adjacent images. This produces an effect similar to the following:
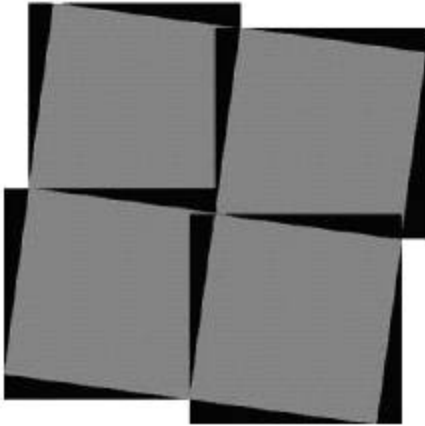
In image mosaics such as this, the black transparency border of some images obscures valid image data in other images.

In order to mosaic these images without data loss, GeoExpress can be instructed to read the transparency areas in the input images as transparent. You can specify a color (or shade of gray) in the input image data to be transparent. The MrSID image produced is seamless, with no loss of data due to transparency borders.

To specify a transparency pixel value, determine the RGB value of the transparency area in the source image. Most commonly, this will be black (0-0-0) or white (255-255-255). If desired, use a color-finder program to read the transparency RGB values. Once the RGB values for the transparency area has been determined, they must be entered manually.

If you have overlapping data, it is recommended that you despeckle the input tiles first or use lossless input images.

For more information see General MrSID advanced options on page 24.

Working with Metadata

This section offers information about all aspects of working with LizardTech metadata; that is, metadata in the MrSID and JPEG 2000 formats. There are two workflows for editing metadata: applying metadata as images are encoded and modifying metadata in existing images. Setting metadata is done in the Metadata Manager and works the same way for both workflows.

For information on NITF metadata, see NITF metadata on page 71.

Types of LizardTech Metadata

There are two categories of LizardTech metadata, **user metadata** and **image metadata**. The information for user and image metadata is contained in **metadata tags**.

User Metadata

LizardTech user metadata is merely descriptive and has nothing to do with the image pixel data. There are 12 default user metadata tags. They can be thought of as addenda or footnotes and include such data as geographic location, company name, and scan info. You can include data for any or all or none of the tags, and you can add your own custom user metadata tags for other information you would like to include. All of LizardTech's user metadata tags can be edited.

Image Metadata

LizardTech image metadata is information about the pixel values that tells viewing software how to interpret or treat each pixel. There are many image metadata tags (see LizardTech image metadata below), and a small subset of these are available for editing (see mrsidgeometa on page 119).

> NOTE: Editing the image tags does not affect the pixel values themselves. For example, changing WKT metadata does NOT reproject an image from one CRS to another. However, changing metadata may affect how an image is **displayed** in a viewer.

LizardTech image metadata

In addition to world files, GeoExpress embeds encoded MrSID and JPEG 2000 images with a header to preserve metadata from source images. This header is able to carry information on image location, projection, date produced, and RGB color lookup tables (CLUT) for indexed color images. Each tag is accompanied by a short description of the method used to write out the data, either ASCII, signed or unsigned 8-bit, signed or unsigned 16- or 32-bit integers, or single or double-precision floating point.

Certain input image types such as NITF, GeoTIFF, ERDAS IMAGINE and USGS DOQ may have additional metadata tags. Such tags are carried over from the source image as-is to the output file in addition to the standard LizardTech metadata tags. If the image being encoded is a mosaic, GeoExpress preserves the metadata values from the first image in the mosaic. If no information is available for a specific tag, the tag is left out of the header. Some tags apply to any MrSID or JPEG 2000 image, with or without georeferencing information; other tags apply specifically to georeferenced images.

> NOTE: When encoding GeoTIFF imagery, all the native GeoTIFF metadata tags are stored as LizardTech metadata tags prepended with the string `GEOTIFF_CHAR::`.

In addition there are special tags that contain statistical information about the pixel intensities in an encoded image. These tags contain the minimum, maximum, mean, and standard deviation of the pixel values in the image. For a grayscale image, single values are output. For an RGB image, values are output in an array where the first value represents the red band, the second band represents the green band, and the third band represents the blue band.

Both the `mrsidgeoinfo` command line tool and ExpressView Browser Plug-in can display LizardTech metadata and GeoTIFF tags. Both tools are included on the GeoExpress DVD.

LizardTech metadata tags

The tags written into MrSID and JPEG 2000 metadata are listed below. If an image or mosaic is cropped while being encoded, the values apply to the cropped output image unless noted otherwise. There is no predetermined order for the tags.

TAG	DESCRIPTION	NOTES
IMAGE::BITS_PER_SAMPLE	Number of bits per sample (uint16)	
IMAGE::COLOR_SCHEME	Colorspace of image (uint32)	Values: 0 for RGB, 3 for grayscale, 2 for CMYK, 10 for multispectral
IMAGE::DATA_TYPE	Datatype of samples in image (uint32)	Values: 0 for unsigned 8-bit int, 1 for 32-bit float, 2 for unsigned 16-bit int

TAG	DESCRIPTION	NOTES
IMAGE::DEFAULT_DATA_VALUE	Sample values for background pixel	Stored as an array of values, one for each band, in order. The values are stored in the datatype of the samples **NOTE:** With older images containing uint8 data, the tag IMAGE::NO_DATA_VALUE below may be used
IMAGE::DYNAMIC_RANGE_ WINDOW	Custom contrast setting (double)	Represents the size of the range of the data
IMAGE::DYNAMIC_RANGE_ LEVEL	Custom brightness setting (double)	Represents the midpoint of the range of the data
IMAGE::EOM	End of metadata	
IMAGE::HEIGHT	Height of the image, in pixels (uint32)	
IMAGE::INPUT_FILE_SIZE	Size of the input image or mosaic in bytes (double)	
IMAGE::INPUT_FORMAT	Name of input image type (string)	
IMAGE::INPUT_LUT	Color lookup table	Stored as an array of 256 × 3 values, one value for each band (R,G,B) for each of the 256 entries in the table.
IMAGE::INPUT_NAME	Filename of the input image (string)	
IMAGE::NO_DATA_VALUE	Sample values for background pixel	Used only by older MrSID images; see IMAGE::DEFAULT_DATA_VALUE above
IMAGE::SOM	Start of metadata	
IMAGE::TRANSPARENT_DATA_ VALUE	Sample values for the "no data" pixel	Stored as an array of values, one for each band, in order. Values are stored in the datatype of the samples
IMAGE::WIDTH	Width of the image, in pixels (uint32)	
IMAGE::X_RESOLUTION	Georeferencing pixel resolution in x-direction (double)	
IMAGE::XY_ORIGIN	Georeferencing (x, y) location for the center of the upper left corner pixel	Stored as an array of two doubles
IMAGE::Y_RESOLUTION	Georeferencing pixel resolution in x-direction (double)	

Area of Interest (AOI) tags

The tags in the table below apply only to images encoded with an Area of Interest.

TAG	DESCRIPTION	NOTES
`IMAGE::AOI::N::REGION::VECTOROVERLAY`	Name of vector overlay file, if any (string)	
`IMAGE::AOI::N::REGION::VECTOROVERLAY_LAYER`	Layer number from vector overlay file, if one is used (integer)	
`IMAGE::AOI::N::REGION::X`	Upper left X pos of region (integer)	
`IMAGE::AOI::N::REGION::Y`	Upper left Y pos of region (integer)	
`IMAGE::AOI::N::METHOD`	The AOI method used (string)	Values: `"shift inner"`, `"shift outer"`, `"weight"`
`IMAGE::AOI::N::WEIGHT`	Weight value used (double)	
`IMAGE::AOI::N::MAGNIFICATION`	Magnification at which AOI was applied (double)	
`IMAGE::AOI::N::NAME`	Optional name of AOI region (string)	
`IMAGE::AOI::N::COMMENT`	Optional comment for AOI region (string)	
`IMAGE::AOI::N::URL`	Optional URL referring to AOI region (string)	

MG2-specific tags

The classical tags in the table below apply to MG2 images only:

TAG	DESCRIPTION	NOTES
`IMAGE::COMPRESSION_BLOCK_SIZE`	Block size used in MrSID encoding (uint32)	
`IMAGE::COMPRESSION_GAMMA`	G-weight value used in MrSID encoding (float)	
`IMAGE::COMPRESSION_VERSION`	Version of encoder used (array of 3 sint32 values)	
`IMAGE::COMPRESSION_WEIGHT`	Weight value used in MRSID encoding (float)	
`IMAGE::CREATION_DATE`	Date and time of image encoding (string)	

TAG	DESCRIPTION	NOTES
IMAGE::COMPRESSION_NLEV	Number of zoom (resolution) levels in the image (uint32)	
IMAGE::STATISTICS:MAXIMUM	Maximum sample values for each band in the input image (array of values)	The number and datatype of the values correspond to the number of bands and sample type of the image
IMAGE::STATISTICS:MINIMUM	Maximum sample values for each band in the input image (array of values)	The number and datatype of the values correspond to the number of bands and sample type of the image
IMAGE::STATISTICS:MEAN	Average value of all samples for each band (array of doubles)	
IMAGE::STATISTICS:STANDARD_DEVIATION	Standard deviation of all samples for each band	
IMAGE::TARGET_COMPRESSION_RATIO	Compression ratio used for encoding (float)	For MG2, this only approximates the actual compression ratio achieved

MG4-specific tags

The tags in the table below apply to MG4 images only:

TAG	DESCRIPTION	NOTES
IMAGE::QUANTIZATION_SCALE	Precision value used for quantization	For floating point images, GeoExpress uses the quantization compression method. For more information on the precision value, see Floating point quantization precision on page 31.

Other metadata tags

When using GeoTIFF input images, the GeoTIFF metadata tags are copied directly into the MrSID or JPEG 2000 file. When using ERDAS IMAGINE and USGS DOQ metadata, certain other custom metadata tags are inserted as well.

For information about how GeoExpress handles existing NITF metadata, see NITF metadata on page 71.

Adding custom metadata

You can add information to the metadata header of a MrSID or JPEG 2000 file by creating new USER tags. To display the names and values of existing USER tags for an image, use the mrsidinfo tool or the ExpressView Browser Plug-in. To add custom tags to an image you must use the `-metadatafile` switch along with an auxiliary file.

Twelve user-defined tags are available by default, so the metadata auxiliary file is a simple text file that consists of no more than 12 lines of text, a line being defined by a carriage return character. The order of the text must be as follows:

METADATA	TAG
Company Name	USER::COMPANY_NAME
Copyright	USER::COPYRIGHT
Credit	USER::CREDIT
Summary	USER::SUMMARY
Keywords	USER::KEYWORDS
Comments	USER::COMMENTS
Image ID	USER::IMAGE_ID
Imaging Date	USER::IMAGING_DATE
Imaging Time	USER::IMAGING_TIME
Source Device	USER::SOURCE_DEVICE
Scan Info	USER::SCAN_INFO
Geographic Location	USER::GEOGRAPHIC_LOCATION

You can also add your own custom tags using the `mrsidgeometa` tool included with your product (see mrsidgeometa on page 119).

Blank lines may be used to ignore certain fields.

Example

Here is an example of a custom metadata text file. The blank lines below represent ignored fields.

```
MyCompany, Inc.
Copyright (C) 2018



This is a picture of my neighborhood
Image ID: 123
January 3, 2018
7:35pm

300dpi
Seattle, WA
```

Setting transparency metadata

When you set values for transparency metadata, you specify the value for each band that contains no data. GeoExpress can use the transparency metadata that you specify to create an alpha band for your image. For more information on alpha bands, see Alpha bands and MrSID on page 30. You can set transparency metadata for images with the MrSID Generation 3 and MrSID Generation 2 output formats. Because images in the MrSID Generation 4 (MG4) format already contain alpha bands, you cannot set transparency metadata for images in the MG4 format.

To set values for transparency metadata, use the `-tpc` switch. Set transparency values in the following format:

```
-tpc <band_number>@<color_value>
```

To specify multiple bands with the same color value, use a comma separated list of bands. For example, to specify that bands one, two, and three use a color value of zero, you might enter the following string:

```
-tpc 1,2,3@0
```

To specify multiple bands with multiple color values, use a comma separated list of band-color pairs. For example, to specify different color values for bands one, two, and three, you might enter the following string:

```
-tpc 1@0,2@1,3@2
```

To specify a range of bands that use the same color value, use a colon. For example, to specify that bands one through three use a color value of zero, you might enter the following format:

```
-tpc 1:3@0
```

To specify that one band uses one color value and that all other bands use another color value, use the REMAINDER parameter. For example, to specify that band one uses a color value of 127 and that all other bands use a color value of zero, you might enter the following string:

```
-tpc 1@127,REMAINDER@0
```

For 8-bit and 16-bit images you can also specify a transparency value using RGB values. To enter hexadecimal values, use the following format:

```
-tpc RRR_GGG_BBB
```

For example, to specify black as the transparency color with RGB values, enter the following string:

```
-tpc 000_000_000
```

> **NOTE:** To change the metadata of existing MrSID images, use the `mrsidgeometa -tpc` command. If an image contains transparency metadata that is not valid, you can remove the transparency metadata with the `mrsidgeometa -rtpc` command. For more information on the mrsidgeometa application, see mrsidgeometa on page 119.

Generating dynamic range metadata

To improve the appearance of MrSID images in other GIS programs, you can use GeoExpress to write dynamic range metadata for images.

For an image where the dynamic range is less than the full range of possible values for the image, you can use your GIS program to stretch the pixel values across the full range. For example, if you have a 16-bit image and the dynamic range is 11 bits, then you may want to use dynamic range stretching to improve the appearance of the image.

To calculate the dynamic range of an image, use the `mrsidgeometa -gdr` command or the `mrsidgeoencoder -dr` command.

```
mrsidgeometa -gdr
```

Use the `mrsidgeometa -gdr` command to add dynamic range metadata to an existing image. You can add dynamic range metadata to any MrSID or JPEG 2000 image.

```
mrsidgeoencoder -dr
```

Use the `mrsidgeoencoder -dr` command to create a new MrSID image with dynamic range metadata included. You can only use the command to create MrSID Generation 4 images.

Dynamic range generation methods

When you generate dynamic range metadata, you must enter a dynamic range generation method.

You can enter one of the following methods for generating the dynamic range:

rgb: Calculate the minimum and maximum dynamic range values for an image with red, green, and blue bands. Select the **rgb** method to minimize color shifting for RGB images. When you select the **rgb** method, GeoExpress calculates the combined dynamic range of the red, green, and blue bands.

merge: Calculate the minimum and maximum dynamic range values for an image with multiple bands. Select the **merge** method to preserve the proportions of pixel values across bands. For example, if you want to compare multiple bands in a multispectral image, you may want to select the **merge** method. When you select the **merge** method, GeoExpress calculates the combined dynamic range of all bands.

per-band: Calculate the minimum and maximum dynamic range values for an image with one or more bands. Select the **per-band** method to calculate the dynamic range of each band individually. For example, if you have a multispectral image and you only want to view one band at a time, select the **per-band** method. When you select the **per-band** method, GeoExpress calculates the dynamic range of each band separately.

Automatic and Strict dynamic range

For all images except for 16-bit images with unsigned integer data, GeoExpress uses the exact dynamic range values from the dynamic range generation method that you select. For 16-bit images with unsigned integer data, GeoExpress automatically modifies the calculated dynamic range values to minimize color shifting.

The modified or automatic dynamic range sets the maximum dynamic range value to the estimated bit-depth and sets the minimum dynamic range value to zero. The estimated bit-depth is the next whole number of bits that contains the calculated maximum value in the image. For example, if the maximum value in the image is 3950, GeoExpress estimates that the image was taken with a 12-bit camera and sets the maximum value to 4095. Because GeoExpress sets a wider dynamic range for the image, you can minimize color shifting when you display the image.

For 16-bit images with unsigned integer data, you can force GeoExpress to use the exact dynamic range values calculated by GeoExpress rather than the modified dynamic range values. To use the exact dynamic range values calculated by GeoExpress, append `-strict` to the dynamic range generation method that you select. For example, you might change the dynamic range generation method to `merge-strict`.

Examples

```
mrsidgeometa -f 4band.sid -gdr rgb-strict
mrsidgeoencoder -i 4band.sid -o 4band_out.sid -dr rgb
```

Chapter 5: LiDAR Data
LiDAR overview

You can use GeoExpress to compress, crop, and reproject LiDAR point clouds and create mosaics. Many of the switches for input and output options are the same for raster and LiDAR data.

For more information about the compressed output formats supported for LiDAR data, see Comparison of compressed output formats on page 80.

Basic LiDAR switches

SWITCH	NOTES
`-input / -i`	Identifies the input source file. It can be a full path name, or a path that is relative to the current working directory. Example: `-i foo.las`

`-inputformat / -if`	Identifies the input file format. Accepted formats are:
	  `las`: LAS format
	  `laz`: LAZ format
	  `sid`: MrSID Generation 4 (MG4) LiDAR format
	  `txt`: LiDAR text file

`-mosaic / -mos`	Identifies the input file as a mosaic list. The file must have a `.list` extension. See below for more information.
`-output / -o`	Identifies the name of the file that GeoExpress creates. It can be a full path, or a path that is relative to the current working directory. Example: `-o myfile.sid`

`-outputformat / -of`	Identifies the desired output format of the file that is to be encoded. Accepted formats are:
	  `las`: LAS format
	  `laz`: LAZ format
	  `mg4`: MrSID Generation 4 (MG4) LiDAR format
	The default output format is MrSID Generation 4.

The following command creates a MrSID file from a LAS file:

```
mrsidgeoencoder -i in.las -o out.sid
```

Mosaics

To create point cloud mosaics in GeoExpress, create a text file that lists the point clouds that you want to mosaic. The file must have a `.list` extension. The point clouds that you want to mosaic must be georeferenced, and the resulting mosaic can only be saved to the MrSID Generation 4 (MG4) format.

For example, to create a mosaic of four LAS files, you might create the following file:

```
cloud_nw.las
cloud_ne.las
cloud_sw.las
cloud_se.las
```

The following command uses the file to create a mosaic:

```
mrsidgeoencoder -i mosaic.list -mos -o mosaic.sid
```

> **NOTE:** LiDAR mosaics are different from raster mosaics. You cannot create composite LiDAR mosaics, and LiDAR mosaic files must have a `.list` extension, not `.mos`.

LiDAR input switches

This table describes LiDAR-specific input switches, especially for working with LiDAR data in text file format.

SWITCH	NOTES
-overrideSRS / -orsrs	The EPSG or well-known text (WKT) string to use for the source file. Enter an EPSG code in quotes or specify a file that contains a WKT.
-textFileColumns / -tfc	For LiDAR text files, map columns to value types. See LiDAR text file columns below for more information.
-textFileOffset / -tfo	The number of header rows in the text file. If you do not enter a number, GeoExpress assumes that all rows include valid values.
-textFileQuantization / -tfq	Set the quantization scale value. See LiDAR text file quantization below for more information.

LiDAR text file columns

When you use a LiDAR text file as input, you must map the columns in the file to the types of values to which they correspond. The following list displays the value types and the letters that represent them:

LETTERS	VALUE TYPES
x, y, z	Point values
i	Intensity
r	Return number
n	Number of returns
d	Scan direction
e	Edge of flight line
a	Scan angle
c	Class ID
p	Source ID
u	User data
t	GPS week time. The number of seconds since the beginning of the week.
T	GPS adjusted time. The number of seconds since 1980 minus one billion.
R	Red
G	Green
B	Blue
s	Skip

To omit a column from the output, use the Skip value type. Any values that you do not map are automatically omitted. For example, if you map four columns, but the input has nine columns, the last five columns are omitted.

Examples

```
mrsidgeoencoder -i in.las -o out.sid -orsrs "EPSG:4326"
mrsidgeoencoder -i in.txt -o out.sid -tfc sxyz
```

LiDAR text file quantization

The quantization scale value is a number that represents the minimum spacing between points. The value is relative to the units of the input image. Typical values are decimal numbers. The default value is 0.01.

```
mrsidgeoencoder -i in.txt -o out.sid -tfc xyzi -tfq 0.05
```

MG4 LiDAR switches

When you create MrSID Generation 4 (MG4) LiDAR files, you can specify additional options.

SWITCH	NOTES
`-compressionratio / -cr`	The compression ratio to use when creating the file. The resulting file is a lossy file, which may have fewer points than the original point cloud. For example, entering a compression ratio of 10 will result in a file size that is 10 times smaller than the nominal size of the input image.
`-lossless`	The file that you compress will be compressed losslessly. This option is used by default.
`-blocksize / -bs`	The number of points to process and store at one time. Enter a large block size to increase compression speed. Enter a small block size to decrease memory usage. Valid values are from 2048 to 16384. The default value is 4096.
`-removeCustomVLRs`	Omit custom variable length record (VLR) metadata from LAS files. VLR metadata can include vendor-specific data, user-specified data, and more.
`-tempdir`	The directory to use for temporary files. Compressing LiDAR point clouds, especially large point clouds, creates many temporary files before writing output to a MrSID image. By default, GeoExpress uses the system-defined temporary directory for the user.

Chapter 6: JPEG 2000 Images
JPEG 2000 encoding

GeoExpress enables your applications to use JPEG 2000 compression on geospatial images with the same level of efficiency, metadata, and large-image support already available with MrSID. JPEG 2000 image compression offers many of the advantages implemented in the MrSID format, plus the added benefits of being an international standard (ISO/IEC 15444).

> **NOTE:** Some applications that support JPEG 2000 do not support all of the features that are required to implement the GMLJP2 standard. For more information, see Output format specifier below.

JPEG 2000 supports multiple bands, so multispectral output can be created from multispectral input without having to go through an output color space (see Creating multiband JPEG 2000 files on page 65).

Area of interest encoding for JPEG 2000 images is covered in the chapter Encoding Areas of Interest on page 33.

Output format specifier

Use the `-outputformat` / `-of` switch to specify the desired JPEG 2000 output format.

If you do not specify an output format with this switch, the default output format is `MG4`.

> **NOTE:** GeoExpress supports encoding JPEG 2000 files in two different modes, "Part I" and "GMLJP2". GMLJP2 is the best option for most workflows. For applications that do not support GMLJP2, the Part I mode generates files that do not use any Part II extensions. GMLJP2 metadata is not available in this mode. Other encoding features, such as the use of NPJE profiles and other metadata forms, are still available. Use the Part I mode only when you are sure that the image user's workflow entails applications that cannot read GMLJP2 files.

The acceptable output format strings for JPEG 2000 encoding are:
> `gmljp2`: JPEG 2000
> `jp2`: JPEG 2000 (Part I)
> `nitfjp2`: NITF encoded as JP2

The information included below is provided with the assumption that the user is familiar with the JPEG 2000 standard. Parameter choices accommodated by the JPEG 2000 specification are of such a broad and varied range that it is possible for users to select settings that prove counterproductive to their goals. In particular, some optimal encode settings can result in degraded decode performance. Considerable trial and error may be required to achieve desired results when diverging from defaults and recommended settings.

JPEG 2000 encode options

All of the basic encode options and some of the advanced options that are available for MrSID encoding are also available for the JPEG 2000 format. Certain advanced operations such as creating and updating composites and optimizing images are not available for JPEG 2000 encoding.

Options available for JPEG 2000 encoding include:
- specifying a target compression ratio
- encoding the image losslessly
- selecting the number of zoom levels the output image has
- specifying a target thumbnail size
- encoding the image with the maximum number of supported zoom levels
- creating a "test encode", which adds a watermark pattern and does not decrement the data cartridge

Color space

JPEG 2000 images can be created with an essentially unlimited number of bands, so multispectral output can be created from multispectral input without having to go through an output color space. When outputting MrSID data, the color compositor is restricted to creating RGB color composites, but for JPEG 2000 encoding, the color compositor allows multibanded images to be created from files representing individual bands.

For more information see Creating multiband JPEG 2000 files on page 65.

> **NOTE:** GeoExpress currently does not support the CMYK color space for JPEG 2000 images, either as input or output. For source images that are CMYK, the only supported output color space for JPEG 2000 encoding is grayscale. The preview input image color space controls remain the same.

JPEG 2000 switches

SWITCH	VALUE	NOTES
`-profile`	string	Specifies a predefined group of encode settings. Supported named profiles are: `NPJE`: "NGA-Preferred JPEG 2000 Encoding" settings. The NPJE profile sets the values to approximate the preferred parameters of the National Geospatial-Intelligence Agency (NGA) for encoding images for panning and zooming at high resolution. `EPJE`: "Exploitation Preferred JPEG 2000 Encoding" settings. The EPJE profile is optimal for low-resolution browsing among images. `Large`: Uses optimal settings for creating large JPEG 2000 images `Default`: LizardTech's general purpose JP2 encode settings. These are **not** the same as the GeoExpress default encode settings, which are recommended for large images. See Default JP2 settings on page 63.
`-bitsofprecision / -bop`	uint	Enables you to choose how many significant bits are to be used from the samples of the source imagery. For example, an image may consist of 16-bit data values, but only eleven of those bits may be meaningful. By default full precision is used.
`-qualitylayers / -ql`	uint	Indicates the number of quality layers with which to encode the image. Among other things, quality layers enable better "streaming" (progressive transmission and display) in some applications. Default: 30.
`-tilesize / -ts`	sint0 sint1	Specifies the use of tiles in encoding and their size (in pixels). If enabled, the tile size must be no larger than the dimensions of the source image. Smaller tiles reduce the amount of memory required to encode the image, however the use of tiles may introduce edge artifacts. Default: 4096 × 4096. Enter 0 × 0 to disable.
`-flushperiod / -flush`	uint	Enables codestream flushing, measured in rows of pixels. When codestream flushing is enabled, less memory may be required to encode the image. The flush period should be on the order of the strip height being used. Using the flush period should not significantly affect output image quality. Default: 4096.

SWITCH	VALUE	NOTES
`-precincts / -prec`	string	Specifies precinct sizes. Precincts are width-height pairs whose use may improve the performance of decode operations for certain image encodings such as those in which tiles are not used. The input format is `<w1, h1, w2, h2,...wn, hn>` where *n* is the number of zoom levels in the image. If you specify fewer than *n* precincts, the last one will be repeated for the remaining levels. Precinct sizes must be powers of two, except for the last one in the list, which has the lowest resolution. By default the use of precincts is enabled. Default for both width and height: 256.
`-noprecincts / -noprec`		Specifies disabling precincts.
`-nogmljp2`		Specifies that GMLJP2 metadata should not be included. See About GML and GMLJP2 on page 65.
`-noembedschemas`		Specifies that GMLJP2 schemas should not be embedded in the output file.

`-tileparts / -tp`	string	Specifies the organization of tile parts in the codestream. Any combination of the letters R, L, and C is valid.
		    N: disable tile parts
		    R: group tiles by resolution
		    L: group tiles by quality layer
		    C: group tiles by component
		Default: R

`-progressionorder / -porder`	string	Progression order may have a significant impact on the time and memory usage required to encode and/or decode the image. Different progression orders should be used for different target workflows. Valid values are LRCP, RLCP, RPCL, PCRL, and CPRL. Default : RPCL
`-codeblocksize / -cbs`	sint0 sint1	Specifies the width and height (in pixels) of the codeblocks used to encode the image. Default: 64. **Note:** for JP2 codeblock size restrictions, see JPEG 2000 encoding on page 58.
`-usepltmarkers / -plt`		Enables the use of packet length markers. Use of packet length markers may improve decoding performance. By default packet length markers are used.
`-use97wavelet`		Specifies that the floating point 9-7 wavelet be used for encoding, instead of the default integer 5-3 wavelet. The 9-7 wavelet will not encode an image losslessly, however, it may result in a better looking image at higher compression ratios. This option is disabled by default and only available when the `-lossless` option is not specified.
`-profilefile`	string	Specifies path to a profile file to use for setting up encode properties. Additional properties set on the command line will override the profile settings.

SWITCH	VALUE	NOTES
`-stripheight / -sh`	sint	Affects memory usage. Increasing this value may improve runtime performance, but at a cost of requiring more physical memory. This value should be decreased when encoding very large images. Changing the strip height does not affect the quality of the output image. Acceptable values: Even integers from 2 to the image's height. Default: 12.
`-tilelengthmarkers / -tlm`	uint	Specifies use of tile length markers and their size. Using tile length markers may improve decoding performance with tiled JPEG 2000 files. Acceptable values: 1-255 Default: 255. Enter 0 to disable.
`-nopltmarkers / -noplt`		Disables packet length markers.

JP2 codeblock size restrictions

The following restrictions apply to JP2 codeblock size:
- width and height must be powers of two
- width and height must each be greater than 4
- width × height must be less than 4096
- width and height must each be less than width and height of tile size
- width and height must each be less than width and height of image if tile size is not specified

The default codeblock value is 64 × 64.

Mosaicking

Mosaic jobs are encoded the same way for JPEG 2000 output as for MrSID output files. See

JPEG 2000 metadata

Evaluation order of metadata

If an external world file is present, its information trumps any metadata. Absent a world file, metadata are evaluated in the following order of priority:
1. GMLJP2
2. GEOJP2/GEOTIFF
3. MrSID metadata
4. World file metadata

> **NOTE:** If a world file is present, then no coordinate reference system is associated with the output file (a NULL WKT is applied).

GMLJP2 metadata

When JPEG 2000 is specified as the output format, GMLJP2 metadata is included by default, and GML metadata is added to the output file according to the GMLJP2 Application Schema version 3.1.1., which can be found at http://schemas.opengis.net/gml/.

Embedding GML schemas

If GMLJP2 metadata is included, the GML schemas are embedded in the file unless the `-noembedschemas` switch is used. XML data from the `.xsd` files that comprise the GMLJP2 Application Schema is embedded in the output file, eliminating potential dependency on a network for use of the GML data included in the file. The

schemas package has a fixed size of 230 KB, which must be separately factored into output file size estimates (**Note:** this should only be of concern if the intended output imagery is under 10MB). If the `-noembedschemas` switch is used, software applications using the output file may need to retrieve the schemas online.

By default GeoExpress includes the schemas.

For more information about GML and the GML application schemas, see About GML and GMLJP2 on page 65.

Default JP2 settings

The table below indicates GeoExpress' original or "factory" default JP2 settings. Unless you have changed your JPEG 2000 preferences, they are the settings that will serve as defaults for your JP2 encoding.

OPTION	SETTING
Use of tiles	Enabled
Tile Size	4096 × 4096
Quality Layers	30
Strip Height	12
Flush Period	4096
Progression Order	RPCL
Code Block Size	Width: 64 Height: 64
Tile Length Markers	255
Tile Parts	By resolution
Packet Length Markers	Enabled
9-7 Wavelet (Lossy)	Disabled
Precincts	256 × 256
Metadata Forms Included in Output	MrSID, World file, GeoTIFF (GeoJP2)

Using JPEG 2000 profiles

GeoExpress supports applying profiles to JPEG 2000 encode jobs via the `-profile` and `-profilefile` switches. The `-profile` switch allows you to specify one of the LizardTech installed industry profiles with the following names:

NPJE: "NITF Preferred JPEG 2000 Encoding" settings. This profile is optimal for panning and zooming within an image at high-resolution.

EPJE: "Exploitation Preferred JPEG 2000 Encoding" settings. This profile is optimal for low-resolution browsing among images.

Large: Uses optimal settings for creating large JPEG 2000 images

Default: LizardTech's general purpose JP2 encode settings. These are NOT the same as the GeoExpress default encode settings, which are recommended for large images. See Default JP2 settings above.

The files for these profiles are called `lti_npje.xml`, `lti_epje.xml` and `lti_default.xml`. They are located by default in `C:\Program Files\LizardTech\GeoExpress\etc\profiles`.

The -profilefile switch allows you to specify the file name of a custom profile file, such as those that can be created in the GUI version of GeoExpress. Custom profiles cannot be created or saved from the command line version of GeoExpress. The following command line provides an example:

```
mrsidgeoencoder -i foo.tif -o foo.jp2 -of jp2 -profilefile
c:\program_files\lizardtech\geoexpress\etc\profiles\my_custom_profile.xml
```

> **NOTE:** Any encode options that are explicitly set on the command line will override any corresponding settings in any profile you have applied using the -profile or -profilefile switches. The following command line provides an example:
>
> ```
> mrsidgeoencoder -i foo.tif -o foo.jp2 -of jp2 -profile NPJE -tilesize 512
>     512
> ```
>
> This applies the NPJE profile to the job and then resets the tile size to the new value of 512 × 512.

Using the National Geospatial-Intelligence Agency (NGA) profiles

The NPJE and EPJE standardization process is not yet complete. These profiles use settings that are compliant with the NPJE and EPJE standards as the NGA currently defines them; however, if the specifications for the standards change, files encoded using the current NPJE and EPJE profiles may not be compliant with the finalized standards. As the standards evolve, LizardTech will make available updated profiles (XML files) to reflect any changes to the standards. Contact your LizardTech representative (https://www.lizardtech.com/sales#retail-sales) to learn more.

The 9-7 wavelet and NPJE/EPJE lossless encoding

While the floating point 9-7 wavelet is visually lossless and sometimes yields better image quality than the 5-3 wavelet, it is NOT numerically lossless. By default, GeoExpress uses the 9-7 wavelet in the NPJE and EPJE profiles, except when lossless encoding is specified. In that case, GeoExpress uses the lossless 5-3 wavelet that it uses in other JPEG 2000 encoding.

Encoding with alpha bands in JPEG 2000

JPEG 2000 supports the use of an alpha band or channel for masking out portions of an image. GeoExpress supports creating alpha bands in JPEG 2000 files where the TIFF or JPEG 2000 source image has an alpha band.

By default, when an image that has an alpha band is encoded to the JPEG 2000 format, GeoExpress encodes the alpha band losslessly to preserve its integrity. However, you can force the alpha band to be compressed along with the other bands.

Use the -alphalossless switch with a value of false to specify that the alpha band not be encoded losslessly. For example:

```
mrsidgeoencoder -i foo.tif -o foo.jp2 -alphalossless false
```

By default this value is set to true and the alpha band is encoded losslessly.

> **NOTE:** For users of GeoExpress Standard Edition, the encoding of the alpha band does not additionally decrement your data cartridge. Your encode job will be metered the same with or without alpha bands.

About GML and GMLJP2

GeoExpress allows Geography Markup Language (GML) metadata to be added to JPEG 2000 (JP2) imagery to comply with the Open Geospatial Consortium (OGC) GMLJP2 standard.

What are GML and GMLJP2?

GML (Geography Markup Language) is an open, XML-based specification for representing geographic information including geographic features, coverages, observations, topology, geometry, coordinate reference systems, units of measure, time and other values. Because it is an XML grammar, it is both extensible and adaptable to any application within the broad geospatial field.

As a wavelet-based image compression format, JPEG 2000 (JP2) is capable of handling images into the gigabyte range and beyond. But until recently, JP2 was not particularly suited to the needs of the geospatial community because it didn't have a designated geospatial metadata standard. However, because the JPEG 2000 format allows for the inclusion of XML data, GML has emerged as the ideal partner for JPEG 2000 imagery, bridging the gap between JP2 and GIS.

GMLJP2 is the specification that standardizes that partnership and opens the door for greater interoperability between your imagery and the thousands of current and future geospatial applications that might use it. Containing its own geographic metadata, your JP2 imagery becomes "spatially aware" and is thus of increased value in geospatial applications. Prior to the adoption of GMLJP2, the lack of a geospatial metadata standard meant that applications and viewers may or may not have been able to read geospatial metadata in a JPEG 2000 file.

What kind of standard is GMLJP2?

The GMLJP2 specification was officially adopted in February 2006 by the Open Geospatial Consortium (OGC) as an open standard for representing geographic information in JPEG 2000 imagery. LizardTech supports open standards and is committed to the success of the GMLJP2 specification.

Jointly proposed and developed by LizardTech, Galdos Systems and a consortium of forward-looking aerospace and technology companies, GMLJP2 represents the most advanced means of including geographic metadata within compressed geospatial imagery and making that information useful in downstream applications now and in the future.

GMLJP2 in GeoExpress

GeoExpress already offers the most complete and easy-to-use implementation of the open JPEG 2000 standard. Now, your JP2 imagery encoded with GMLJP2 metadata is secure for the future because, like JPEG 2000, the GMLJP2 specification is an open, non-proprietary standard.

> **NOTE:** Some applications that support JPEG 2000 do not support all of the features that are required to implement the GMLJP2 standard. For more information, see About GML and GMLJP2 above.

The GML option is available among the metadata control settings of the advanced JPEG 2000 encode options.

Links

Learn more about the GML and GMLJP2 specifications at http://www.opengeospatial.org/specs/?page=specs.

The GMLJP2 Application Schema version 3.1.1. can be found at http://schemas.opengis.net/gml/.

Creating multiband JPEG 2000 files

The GeoExpress color compositor allows multibanded JPEG 2000 images to be created from files representing individual bands. (For MrSID encoding, use the `-redband`, `-greenband`, and `-blueband` switches to create

RGB color composites.) **Note:** Color composites are single images and should not be confused with composite mosaics.

Since multiband color composites contain an arbitrary number of bands, the input files must be specified with a specially formatted text file. The text file is a comma-delimited list of files and band numbers. Each line is in the following format:

```
<full path of file name>,<1-based band number>
```

Input files must be singleband grayscale images that share the same dimensions, resolution, bit depth, and geographic positioning. Empty bands can be specified by leaving the file name blank, followed by the desired band number. The total number of bands in the color composite image is determined by the band with the highest band number. Bands do not need to be listed in numerical order.

Following is an example text file for a multiband color composite:

```
c:\temp\file1.tif,3
c:\temp\file2.tif,1
,6
c:\temp\file3.tif,5
```

This creates a six-banded image, since the highest band number is the empty band in line 3. Bands 2, 4, and 6 are empty, and bands 1, 3, and 5 are `file2.tif`, `file1.tif`, and `file3.tif` respectively.

The command line switch for creating a multiband color composite is `-colorcomp` / `-ccmp`. Specify the input file using the `-input` switch. The `-inputformat` switch can be used to force all of the files in the text file to be opened as a specific type. A sample command line for creating a multiband color composite would be:

```
mrsidgeoencoder -i infile.txt -colorcomp -o outfile.jp2 -of jp2
```

If you specify MrSID as an output format, you must also supply a target color space, since MrSID doesn't support multispectral imagery. For example:

```
mrsidgeoencoder -i infile.txt -colorcomp -o outfile.sid -of mg3
    -targetrgb 3 1 5
```

This would take the example text file and create an RGB image using bands 3, 1, and 5.

Chapter 7: NITF Images
NITF overview

GeoExpress allows you to create National Imagery Transmission Format (NITF) images with GeoExpress. The acronym NITFS sometimes seen refers to the NITF standard, which was created by the Department of Defense as a means of formatting digital imagery and imagery-related products and exchanging them among members of the intelligence community, the Department of Defense (DOD), and other government departments and agencies.

NITF was created partly because government agencies needed a single common image representation that supported certain metadata features and workflows. While it is called an image format, NITF is perhaps more precisely described as a file format that wraps image files and metadata about those files.

> **NOTE:** When you use a NITF file as an input image, sometimes the band order of the image does not match the band order in the metadata. If this is the case, GeoExpress changes the order of bands in output images to match the metadata band order.

NITF compliance in GeoExpress

GeoExpress supports the following NITF standards:

- version 2.1 of the NITF file format (MIL-STD-2500C, May 2006, plus change outlined in RFC NTB-038) for writing
- versions 2.1 and 2.0 of the NITF file format for reading
- version 01.10 of the BIIF Profile for JPEG 2000 (BPJ2K01.10, April 2009) including the J2KLRA TRE
- version 2.1 of the Commercial Dataset Requrements Document (NCDRD STDI-0006, February 2010)
- version 1.0 of the Implementation Practices of NITF (STDI-0005 IPON v1.0, August 2007)
- version 00.20 of the JPEG 2000 Test Plan (BPJ2K01.00 Test Plan Draft Version 00.20, March 2010)

> **NOTE:** These NITF standards may change and future releases will track the evolution of these standards to ensure interoperability.

Creating NITF files

To create a NITF file, use the `-outputformat` switch with either `nitf` or `nitfjp2` as the output type. `nitf` specifies a raw (uncompressed) output file, whereas `nitfjp2` indicates that the NITF file will be encoded as a JPEG 2000 file. The NITF metadata fields can be set by using the `-nitfmetadata` switch and supplying a specially formatted text file. The format of the text file is: `<code>:<value>`, where `<code>` is the six-letter field name as defined in the NITF 2.1 spec and `<value>` is the actual data that the field contains. Only one field is allowed per line, and the `<value>` portion cannot contain new line characters or span multiple lines. The image segment can contain up to nine Image Comment fields, named `ICOM1` through `ICOM9`.

Example

Following is an example of a NITF metadata text file:

```
OSTAID:LizardTech
FDT:20041106071325
FTITLE:File title
ONAME:John Smith
OPHONE:555-123-4567
FSCLAS:U
FSCLSY:
FSCODE:codewords
FSCTLH:
FSREL:
FSDCTP:
FSDCDT:
FSDCXM:
FSDG:
FSDGDT:
FSCLTX:
FSCATP:
FSCAUT:
FSCRSN:
FSSRDT:
FSCTLN:
IID1:Image ID
IDATIM:20030401120059
TGTID:
IID2:
ISORCE:
ICOM1:Image segment comment 1
ICOM2:Image segment comment 2
ICOM3:Image segment comment 3
ISCLAS:U
ISCLSY:
ISCODE:image code
ISCTLH:
ISREL:
ISDCTP:
ISDCDT:
ISDCXM:
ISDG:C
ISDGDT:
ISCLTX:image classification text
ISCATP:
ISCAUT:image classification authority
ISCRSN:
ISSRDT:
ISCTLN:
```

Using this information, the following example shows how you would create a simple uncompressed NITF file on the command line:

```
mrsidgeoencoder -i foo.tif -o foo.ntf -of nitf -nitfmetadata
    MyNITFMetadata.txt
```

For a JPEG 2000 encoded NITF file, all of the normal JPEG 2000 encoding options apply. For example:

```
mrsidgeoencoder -i foo.tif -o foo.ntf -of nitfjp2 -nitfmetadata
    MyNITFMetadata.txt -cr 20 -tilesize 512 512 -porder LRCP
```

This NITF metadata text file format can be extended to target specific image segments by using the -<index> identifier after the field name. For example, to set the image subheader fields for image segment 2, you could enter:

```
...
IID1-2:Image ID
IDATIM-2:20030401120059
TGTID-2:
IID2-2:
ISORCE-2:
ICOM1-2:Image segment comment 1
ICOM2-2:Image segment comment 2
ICOM3-2:Image segment comment 3
ISCLAS-2:U
...
```

For information on how GeoExpress handles existing NITF metadata, see NITF metadata on page 71.

Multiple image segment NITF files

The following new switches support reading and writing NITF files with multiple image segments.

Specifying image segments to encode

To specify which image segments of a multi-segment input file to encode, use the -iseg switch.

SWITCH	VALUE	NOTES
-imagesegments / -iseg	string	Used in conjunction with the -input switch to identify which image segments to use if the input image supports multiple image segments.

Example

```
mrsidgeoencoder -i foo.ntf -iseg 1 -o foo.sid -of mg3
```

Segments are numbered 1-n and specified by a comma delimited list with no spaces. For example:

```
-iseg 1,4,5
```

Image segments and color composite images
RGB color composites

When creating an RGB color composite image, image segments from multisegment files can be specified with the -redseg, -greenseg, and -blueseg switches.

SWITCH	VALUE	NOTES
-redseg	uint	Used in conjunction with the -redband switch to identify which image segment of a multisegment input image to use
-reproerror	float	Specifies the desired error fraction for a reprojection operation. Acceptable values: 0.0-1.0. Default: 0.125.
-greenseg	uint	Used in conjunction with the -greenband switch to identify which image segment of a multisegment input image to use
-blueseg	uint	Used in conjunction with the -blueband switch to identify which image segment of a multisegment input image to use

Multibanded color composites

To use multi-segment image files as input for multibanded color composite files, use the -ccmpseg switch.

SWITCH	VALUE	NOTES
-colorcompseg / -ccmpseg	string	Used in conjunction with the -colorcomp switch to identify which image segments to use if the input images support multiple image segments. Segments are numbered 1 through *n* and specified by a comma-delimited list with no spaces.

Requirements for the -ccmpseg switch:

- the number of segments must equal the number of input files in the color composite file
- the order of the segments must be in the same order as the input files in the color composite file
- only one segment can be specified for each input file in the color composite file.
- use a segment value of 0 for input files that do not support multiple image segments.

For example, a color composite file with six input files could have the following segment values:

```
-colorcompseg 1,2,3,0,0,1
```

Creating mosaics that include multiple image segment files

To create a mosaic that includes multisegment input files, use the -msmos switch and supply a specially formatted text file as the input file.

SWITCH	NOTES
-msmosaic / -msmos	Identifies the input file as a text file of mosaic images with comma delimited image segment identifiers. Each line of the text file must contain the input file name, followed by a comma and then a comma delimited list of the active image segments.

Supplying just the file name will use all image segments. A sample file may look like this:

```
foo1.ntf,1,2
foo2.tif
foo3.ntf,3
foo4.ntf
```

All of the input files must be mosaickable, as per the standard GeoExpress mosaicking rules (see Creating a mosaic on page 43).

Known limitation on making multisegment NITF files from the command line

Using the classic `-mos` AUX file method, a multisegment NITF can be generated using the `-ms` switch. However, using this mechanism it is only possible to set the image subheader metadata for the first segment. To set unique image subheader metadata for each image segment, use either the `-cmos` or `-msmos` text file formats.

Multisegment NITF files require world files. For more information see Creating world files on page 22 and World files on page 42.

Applying NITF RPC

NITF files can include rapid positioning capability (RPC) metadata. RPC metadata maps pixel data to location data for orthorectification. To apply the orthorectification described in the NITF RPC to the image, use the following switch:

```
-applyRPC
```

NITF metadata

You can edit the following metadata for images with the NITF output format:

- File header
- File security fields
- Image subheader
- Image security fields
- Image comments

For more information on NITF metadata, see the NITF 2.1 specification at
http://www.gwg.nga.mil/ntb/baseline/docs/2500c/2500C.pdf.

Viewable NITF Metadata

In addition to the NITF metadata that you can edit, GeoExpress embeds metadata from NITF input files to preserve the source metadata. When reading a NITF file, GeoExpress stores many NITF fields as metadata, for example as tag/value pairs in MrSID imagery.

> **NOTE:** The following discussion assumes familiarity with the NITF specification.

In general, the tag name is of the form
```
NITF::xxnnn::field
```
where `xx` is a two letter code representing the NITF segment (IM for image, FH for file header) and `nnn` is the NITF segment number. TRE fields contain the prefix `TRE_`. Specifically, GeoExpress stores input fields in metadata tags as described in the following tables.

File Header Fields

GeoExpress stores file header fields in the following tags:

NITF FIELD	GEOEXPRESS TAG
FHDR	NITF::FH000::FHDR
FVER	NITF::FH000::FVER
STYPE	NITF::FH000::STYPE
OSTAID	NITF::FH000::OSTAID
FDT	NITF::FH000::FDT
FTITLE	NITF::FH000::FTITLE
ONAME	NITF::FH000::ONAME
OPHONE	NITF::FH000::OPHONE
NUMI	NITF::FH000::NUMI
NUMS	NITF::FH000::NUMS
NUML	NITF::FH000::NUML
NUMT	NITF::FH000::NUMT
NUMDES	NITF::FH000::NUMDES
NUMRES	NITF::FH000::NUMRES

Using GeoExpress, you can set the values for OSTAID, FDT, FTITLE, ONAME, and OPHONE when encoding NITF images.

Security-Related Fields

GeoExpress stores security-related fields from the file header (unless they are blanks) in the following tags:

NITF FIELD	GEOEXPRESS TAG
SCLAS	NITF::FH000::SCLAS
SCLSY	NITF::FH000::SCLSY
SCODE	NITF::FH000::SCODE
SCTLH	NITF::FH000::SCTLH
SREL	NITF::FH000::SREL
SDCTP	NITF::FH000::SDCTP
SDCDT	NITF::FH000::SDCDT
SDCXM	NITF::FH000::SDCXM
SDG	NITF::FH000::SDG
SDGDT	NITF::FH000::SDGDT
SCLTX	NITF::FH000::SCLTX
SCATP	NITF::FH000::SCATP
SCAUT	NITF::FH000::SCAUT
SCRSN	NITF::FH000::SCRSN
SSRDT	NITF::FH000::SSRDT
SCTLN	NITF::FH000::SCTLN

GeoExpress allows you to specify values for any of these fields.

Image Segment Fields

GeoExpress stores image segment fields in the following tags:

NITF FIELD	GEOEXPRESS TAG
IID1	NITF::IM001::IID1
IDATIM	NITF::IM001::IDATIM
TGTID	NITF::IM001::TGTID
IID2	NITF::IM001::IID2
ISORCE	NITF::IM001::ISORCE
ICORDS	NITF::IM001::ICORDS
IGEOLO	NITF::IM001::IGEOLO
NICOM	NITF::IM001::NICOM
ICOM1	NITF::IM001::ICOM1
ICOM2	NITF::IM001::ICOM2
ICOM3	NITF::IM001::ICOM3
ICOM4	NITF::IM001::ICOM4
ICOM5	NITF::IM001::ICOM5
ICOM6	NITF::IM001::ICOM6
ICOM7	NITF::IM001::ICOM7
ICOM8	NITF::IM001::ICOM8
ICOM9	NITF::IM001::ICOM9

With GeoExpress, you can enter custom data for these image segment fields: IID1, IDATIM, TGTID, IID2, ISORCE, NICOM, ICOM1 through ICOM9.

Additional Notes

In addition, GeoExpress does the following:

- Handles the security fields in the Image Segment as they are handled in the file header;
- Stores all detected TREs in metadata as binary data. For example, USE00A data would be stored as an array of bytes using the tag NITF::IM001::TRE_USE00A;
- Explicitly recognizes the following TREs when reading in a NITF file:
  J2KLRA, USE00A, STDIDC, PIAIMC, and RPC00A/B.

For these TREs, additional metadata entries are created corresponding to each of their constituent fields.

For example, PIAIMC data is represented as follows:

    NITF::IM001::TRE_PIAIMC_CLOUDCVR
    NITF::IM001::TRE_PIAIMC_SRP
    NITF::IM001::TRE_PIAIMC_SENSMODE
    NITF::IM001::TRE_PIAIMC_SENSNAME
    …

Chapter 8: Common Commands
Common raster commands

Lossless Compression
The following command compresses a TIFF image to MrSID Generation 4 using lossless compression:
```
mrsidgeoencoder -i foo.tif -o foo.sid -of mg4 -lossless
```

Setting a Compression Ratio
The following command compresses a TIFF image to MrSID Generation 4 using a 20:1 compression ratio:
```
mrsidgeoencoder -i foo.tif -o foo.sid -of mg4 -cr 20
```

Creating a Test Image
The following image creates a watermarked test image that does not deduct from the data cartridge:
```
mrsidgeoencoder -i foo.tiff -testencode -o foo.sid
```

Cropping the Sides of an Image
The following command crops 500 pixels from each side of an image:
```
mrsidgeoencoder -i foo.sid -o foo_crop.sid -cropleft 500 -cropright 500
    -croptop 500 -cropbottom 500
```

The following command defines upper left X and Y coordinates for a crop region, and sets the width and height of the crop region to 4000 by 4000 pixels:
```
mrsidgeoencoder -i foo.sid -o foo_crop.sid -cropulxy 500 500 -cropwh 4000 4000
```

Despeckling
The following command removes speckling artifacts from an image that has been compressed using lossy compression:
```
mrsidgeoencoder -i foo.tif -o foo.sid -of mg4 -cr 20 -despeckle true
```

Reprojecting
The following command changes the projection of an image from one EPSG to another:
```
mrsidgeoencoder -i foo.tif -o foo.sid -fromepsg 4326 -toepsg 26718
```

Creating a Flat Mosaic
The following command uses a mosaic list file to create a flat mosaic:
```
mrsidgeoencoder -i mosaic.mos -mos -o mosaic.sid
```

The file with a `.mos` extension is the mosaic list file. The following lines display the contents of a sample mosaic list file for a given set of georeferenced images:
```
image_nw.tif
image_ne.tif
image_sw.tif
image_se.tif
```

Creating/Updating a Composite Mosaic

The following command uses a mosaic list file to create a composite mosaic:

```
mrsidgeoencoder -i tiles.mos -o outputcomposite.sid -composite
```

The file `tiles.mos` is the mosaic list file. For a composite mosaic, the files listed must all be MG3 or MG4 files. The following is an example mosaic list file:

```
image_nw.sid
image_ne.sid
image_sw.sid
image_se.sid
```

This operation was formerly referred to as updating a mosaic.

Common LiDAR commands

Lossless compression

The following command compresses a LAS point cloud to MrSID Generation 4 using lossless compression:

```
mrsidgeoencoder -i foo.las -o foo.sid -of mg4 -lossless
```

Setting a compression ratio

The following command compresses a LAS point cloud to MrSID Generation 4 using a 15:1 compression ratio:

```
mrsidgeoencoder -i foo.las -o foo.sid -of mg4 -cr 15
```

Compressing a text file

The following command compresses a text file and maps the columns in the text file to fields in the output point cloud:

```
mrsidgeoencoder -i in.txt -o out.sid -tfc txyzi
```

The file above contains the following values: the GPS time, the X values, the Y values, and the intensity.

Cropping

The following command crops a LAS point cloud to MrSID Generation 4 to a rectangle defined by the upper left and lower right corners:

```
mrsidgeoencoder -i foo.las -o foo_cropped.sid -cropulxy 580677 4504756 -
    croplrxy 580791 4504635
```

Reprojecting a point cloud

The following command reprojects a LAS point cloud to MrSID Generation 4 from the original CRS (NAD83 / UTM zone 18N, 26918) to WGS 84 (4326).

```
mrsidgeoencoder -i foo.las -o foo_to4326.sid -fromepsg 26918 -toepsg 4326
```

Creating a flat mosaic

The following command uses a mosaic list file to create a LiDAR point cloud mosaic:

```
mrsidgeoencoder -i mosaic.list -mos -o mosaic.sid
```

The file with a `.list` extension is the mosaic list file. The following lines display the contents of a sample mosaic list file for a given set of georeferenced LAS files:

```
cloud_nw.las
cloud_ne.las
cloud_sw.las
cloud_se.las
```

Appendix A: File Formats
Supported input file formats

This table describes the file formats of the images that you can add to the **Job List**.

FILE FORMAT	FILE EXTENSION	SUPPORTED DATA TYPES	SUPPORTS MULTISPECTRAL?	NOTES
BIPF	`.bpf`		N/A	Binary Point File, commonly used for Geiger Mode LiDAR images.
CADRG	The most common extension is `.toc`	8-bit unsigned	No	
DTED	`.dt0`, `.dt1`, `.dt2`	16-bit signed, 32-bit floating point	No (limited to one band)	
ECW	`.ecw`	8-bit unsigned	Yes	Earth Resoure Mapping's Enhanced Compression Wavelet format.
ERDAS IMAGINE	`.img`	8-bit and 16-bit signed and unsigned, 32-bit floating point	Yes	GeoExpress supports color lookup tables (CLUTs) with 8-bit per sample RGB color values.
ERDAS LAN	`.lan`	8-bit unsigned	Yes	In 4-band LAN images, bands 2, 3, and 4 are interpreted as Red, Green, and Blue, respectively.
JPEG	`.jpg`, `.jpeg`	8-bit unsigned	No, limited to 3 bands	Requires a world file for georeferencing.
JPEG 2000	`.jp2`, `.jpc`	8-bit and 16-bit signed and unsigned	Yes	Multiple bands supported or all color spaces.
LAS	`.las`		N/A	This is a binary, uncompressed LiDAR point cloud format. GeoExpress supports LAS versions 1.0-1.3, with experimental support for LAS 1.4.
LAZ	`.laz`		N/A	This is a binary, compressed LiDAR point cloud format.
MrSID Generation 2 (MG2)	`.sid`	8-bit and 16-bit unsigned, 32-bit floating point	No	4 bands are supported for CMYK input only.
MrSID Gen 3 (MG3)	`.sid`	8-bit and 16-bit unsigned	No	4 bands are supported for CMYK input only.

FILE FORMAT	FILE EXTENSION	SUPPORTED DATA TYPES	SUPPORTS MULTISPECTRAL?	NOTES
MrSID Gen 4 (MG4) LiDAR	`.sid`		N/A	This is a binary, uncompressed LiDAR point cloud format.
MrSID Gen 4 (MG4) Raster	`.sid`	8-bit and 16-bit signed and unsigned, 32-bit floating point	Yes, up to 255 bands	Multiple bands supported for all color spaces.
NITF 2.0, 2.1.	`.ntf`	8- and 16-bit signed and unsigned	Yes	Only supports uncompressed, JPEG compressed, and JP2 compressed data.
PCIDSK	`.pix`	8-bit and 16-bit signed and unsigned, 32-bit floating point	Yes	Does not support mixed data type, RPC segments, GCP segments, or Color Lookup Tables.
PNG	`.png`	8-bit and 16-bit unsigned	No	Requires a world file for georeferencing.
Raw (uncompressed) BBB files (BIL, BIP, and BSQ)	`.bil, .bip, .bsq`	8-bit and 16-bit signed and unsigned, 32-bit floating point	Yes	
Sun Raster	`.ras, .rast`	8-bit unsigned	No	
Text	The most common extension is `.txt`.		N/A	Also known as ASCII files. These are plain-text files with delimiters for point clouds.
TIFF/GeoTIFF	`.tif, .tiff, .tfw`	8-bit and 16-bit signed and unsigned, 32-bit floating point	Yes	For more information on supported TIFF compression formats, see Supported TIFF compression types on page 81.
USGS DOQ	`.nes, .ses, .nws, .sws, .doq`	8-bit unsigned	No	Both the old and new USGS DOQ formats are supported and can be combined in mosaics.
Windows BMP	`.bmp`	8-bit unsigned	No	Requires a world file for georeferencing. Only supported on Windows.

Supported output file formats

Many of the options available to you in GeoExpress vary depending on the output format that you select. Additionally, the options available depend on whether the file is a raster file or a LiDAR point cloud file.

GeoExpress supports the following output formats:

- MrSID Generation 4 (MG4), MrSID Generation 3 (MG3), MrSID Generation 2 (MG2)
- JPEG 2000 (Part I), JPEG 2000 (GMLJP2)
- NITF 2.1 (Raw), NITF 2.1 (JPEG 2000)
- GeoTIFF
- LAS
- LAZ
- BPF

MrSID

The MrSID format is a proprietary format developed by LizardTech that supports lossy and lossless compression. There are several generations of the MrSID file format. Additionally, for the latest generation, MrSID Generation 4 (MG4), there is a version that supports raster and a version that supports LiDAR.

The raster version of MG4 supports multispectral data, per-band compression, custom metadata, and advanced image manipulation features. The format is widely supported across GIS software packages. The LiDAR version of MG4 stores compressed point clouds in an accessible format meant to address some of the problems with storing and accessing large LiDAR point clouds.

For both raster and LiDAR data, if you're not sure which file format to select, you may want to select MrSID Generation 4.

JPEG 2000

The JPEG 2000 format is an open standard that provides superior compression compared to the original JPEG format.The JPEG 2000 (Part I) format uses the original JPEG 2000 specification which is more widely supported. The JPEG 2000 (GMLJP2) format includes support for geographic markup language (GML). Use the JPEG 2000 (GMLJP2) format when you need to create JPEG 2000 files that contain coordinate reference systems (CRS), topology, and other geographic features.

For a comparison of MrSID and JPEG 2000 files, see

NITF

The NITF format is a container that can include an image, image metadata, and other graphics. GeoExpress supports creating NITF files that contain raw or JPEG 2000 images.The NITF format is the standard for various departments of the United States government. Use the NITF format when your organization requires NITF metadata.

GeoTIFF

The GeoTIFF format embeds georeferencing metadata into TIFF images. In GeoExpress, you can only create GeoTIFF files from MrSID input files, and you can only create uncompressed GeoTIFF files. Use the GeoTIFF format when you might need to view your image in an image viewer that does not support GIS. Any image viewer that can read TIFF files will display GeoTIFF images. If the viewer does not support the georeferencing metadata, the metadata is ignored. GeoTIFF is generally an uncompressed file format.

LAS

The LAS format is one of the most commonly used LiDAR file formats, and can be read in virtually any application that support LiDAR point clouds. LAS is a public, uncompressed file format maintained by the American Society

for Photogrammetry and Remote Sensing (ASPRS). GeoExpress can write LAS 1.0 through 1.4 files.

When you create a LAS file from another LAS file, GeoExpress uses the same version of LAS. For example, if the input file is a LAS 1.1 file, GeoExpress creates another LAS 1.1 file. If you write a LAS file from MrSID or from another format, the version of LAS that GeoExpress uses depends on the contents of the file. If the file contains features unique to a specific version of LAS, GeoExpress uses that particular version.

LAZ

The LAZ format is a compressed format for LiDAR point clouds. LAZ is an open-source file format developed by Martin Isenberg at RapidLasso.

GeoExpress does not support LAZ output from a LAS 1.4 file that includes records 6-10.

BPF

Binary Point File (BPF) serves as a lightweight, quick, binary file format for the storage of unorganized point cloud data. It is commonly used in Geiger Mode LiDAR imagery.

Lossy and lossless compression

You may compress your images "losslessly" (using **lossless compression**) or "lossily" (using **lossy compression**). Lossless compression preserves all data. Lossy compression discards some data in order to achieve smaller file sizes. For the purposes of real workflows, however, it is useful to think of GeoExpress as offering three categories of image quality: lossless, visually lossless, and lossy.

Lossless

Lossless compression retains all source image data. No data is discarded. This level of compression typically yields a 2:1 compression ratio, for a 50% reduction in the space required to store the image. Lossless compression should be used when it is critical that all bits of the original image be preserved. This is the case for archival storage, as well as for uncommon workflows where no possible loss of precision is ever acceptable. You may also wish to use lossless compression when you are generating a "master" image from which other derivative images will be made, as through the MrSID optimization process. From a lossless MrSID or JPEG 2000 file, the original TIFF or other raw file can be reassembled identically, bit-for-bit.

> **NOTE:** When you use the lossless option to recompress an image that has already been compressed lossily, it means that no further loss of data will occur. It is helpful to remember that in lossless compression all image data from the source image is retained.

Visually lossless

This is actually a form of lossy compression, and the name is not intended to mislead. Visually lossless represents the limit of data that can be discarded before the human eye can detect any degradation in image quality. This level of compression is typically 20:1 for RGB and 10:1 for grayscale imagery. This is the most common level of compression quality used, as it preserves the appearance of the imagery for most workflows, including use of your imagery as a background layer and for many forms of visual analysis and exploitation.

Lossy

Beyond 20:1, image degradation and artifacts can appear, although often not too significantly until ratios of 40:1 or 50:1. Such lossy quality may be acceptable when the imagery is used only as a background layer for appearance or when the image quality is less important than the storage size or speed, such as for informal visual inspections.

Comparison of compressed output formats

For raster images, GeoExpress can create compressed images in the MrSID and JPEG 2000 formats. Because the NITF format can contain JPEG 2000 files, you can also create compressed NITF files. For LiDAR data, GeoExpress can create compressed files in the MrSID and LAZ formats. For LiDAR data, LAZ files can only be created using lossless compression. MrSID files are lossless by default, but you can also specify a compression ratio to create lossy files.

> **TIP:** To see information about an image, including the file format, width, height, and compression ratio if applicable, use the mrsidgeoinfo tool.

Compressed Raster Formats

The following table compares some of the features supported by the raster output formats:

FEATURE	OUTPUT FORMAT			
	MG2	MG3	MG4	JPEG 2000
Lossy output with a maximum of 3 bands, cropping, no advanced encoding, output file smaller than 2GB	✓	✓	✓	✓
Advanced encoding (such as reprojection, color balancing, despeckling, and Area of Interest encoding)		✓	✓	✓
Output file size larger than 2GB		✓	✓	✓
Lossless output		✓	✓	✓
Mosaic that uses MrSID files as input		✓	✓	✓
Multispectral output			✓	✓
Arbitrary band mapping			✓	
Per-band compression			✓	

Compressed LiDAR Formats

The following table compares some of the features supported by the LiDAR output formats:

FEATURE	OUTPUT FORMAT			
	LAZ	LAS	BPF	MG4
Lossless compression	✓	✓	✓	✓
Using a specified compression ratio				✓
Creating mosaics				✓

For more information on output formats, see Supported output file formats on page 78.

Supported TIFF compression types

The **Job Properties** panel provides information about the input images used in a project. Information about any TIFF compression technique used in the input images is also provided, even if the technique is not supported by GeoExpress.

The following table lists TIFF compression types displayed by GeoExpress and whether the compression type is supported by GeoExpress.

COMPRESSION	SUPPORT
CCITT Group 3 fax	No
CCITT Group 4 fax	No 1
LZW (Limpel-Ziv-Welsh)	Yes
Old JPEG	No
Standard JPEG (including 12-bit)	Yes
NeXT run-length encoding	No
CCITT run-length encoding	Yes 2
Pixar image format	No
Desktop color separation	No
Standard JBIG	No
Pack-bits encoding	Yes
ThunderScan	No
Deflate method (PNG)	No

1 GeoExpress is able to process single-page Group 4 TIFF files, but encoding this format is not recommended.

2 There are many different types of run-length encoding. Some methods are supported; others are not. GeoExpress works best with uncompressed images.

Sample MrSID metadata

Following is the header metadata from a sample MrSID image.

```
Record 0:
Tag: GEOTIFF_CHAR::GTModelTypeGeoKey
Type: ASCII[1]
Data:
[0]: ModelTypeProjected
Record 1:
Tag: GEOTIFF_CHAR::GTRasterTypeGeoKey
Type: ASCII[1]
Data:
[0]: RasterPixelIsArea
Record 2:
Tag: GEOTIFF_CHAR::GeogEllipsoidGeoKey
Type: ASCII[1]
Data:
[0]: Ellipse_GRS_1980
Record 3:
Tag: GEOTIFF_CHAR::GeogGeodeticDatumGeoKey
Type: ASCII[1]
Data:
[0]: Datum_North_American_Datum_1983
Record 4:
Tag: GEOTIFF_CHAR::ProjLinearUnitsGeoKey
Type: ASCII[1]
Data:
[0]: Linear_Meter
Record 5:
Tag: GEOTIFF_CHAR::ProjectedCSTypeGeoKey
Type: ASCII[1]
Data:
[0]: PCS_NAD83_UTM_zone_10N
Record 6:
Tag: GEOTIFF_NUM::1024::GTModelTypeGeoKey
Type: UINT16[1]
Data:
[0]: 1
Record 7:
Tag: GEOTIFF_NUM::1025::GTRasterTypeGeoKey
Type: UINT16[1]
Data:
[0]: 1
Record 8:
Tag: GEOTIFF_NUM::2050::GeogGeodeticDatumGeoKey
Type: UINT16[1]
Data:
[0]: 6269
Record 9:
Tag: GEOTIFF_NUM::2056::GeogEllipsoidGeoKey
Type: UINT16[1]
Data:
[0]: 7019
Record 10:
Tag: GEOTIFF_NUM::3072::ProjectedCSTypeGeoKey
Type: UINT16[1]
Data:
[0]: 26910
Record 11:
Tag: GEOTIFF_NUM::3073::PCSCitationGeoKey
Type: ASCII[1]
Data:
[0]: Universal Transverse Mercator; North American 1983; GRS80; Zone Number 10N
Record 12:
Tag: GEOTIFF_NUM::3076::ProjLinearUnitsGeoKey
Type: UINT16[1]
Data:
[0]: 9001
Record 13:
Tag: GEOTIFF_NUM::3080::ProjNatOriginLongGeoKey
Type: FLOAT64[1]
Data:
[0]: -123.000000
Record 14:
Tag: GEOTIFF_NUM::3081::ProjNatOriginLatGeoKey
Type: FLOAT64[1]
```

```
Data:
[0]: 0.000000
Record 15:
Tag: GEOTIFF_NUM::3082::ProjFalseEastingGeoKey
Type: FLOAT64[1]
Data:
[0]: 500000.000000
Record 16:
Tag: GEOTIFF_NUM::3083::ProjFalseNorthingGeoKey
Type: FLOAT64[1]
Data:
[0]: 0.000000
Record 17:
Tag: GEOTIFF_NUM::3092::ProjScaleAtNatOriginGeoKey
Type: FLOAT64[1]
Data:
[0]: 0.999600
Record 18:
Tag: IMAGE::INPUT_FILE_SIZE
Type: FLOAT64[1]
Data:
[0]: 75121662.000000
Record 19:
Tag: IMAGE::INPUT_FORMAT
Type: ASCII[1]
Data:
[0]: GeoTIFF
Record 20:
Tag: IMAGE::INPUT_NAME
Type: ASCII[1]
Data:
[0]: H:\Seattle\10tet279287.tif
Record 21:
Tag: IMAGE::WIDTH
Type: UINT32[1]
Data:
[0]: 5000
Record 22:
Tag: IMAGE::HEIGHT
Type: UINT32[1]
Data:
[0]: 5000
Record 23:
Tag: IMAGE::COLOR_SCHEME
Type: UINT32[1]
Data:
[0]: 0
Record 24:
Tag: IMAGE::DATA_TYPE
Type: UINT32[1]
Data:
[0]: 0
Record 25:
Tag: IMAGE::NO_DATA_VALUE
Type: UINT8[3]
Data:
[0]: 0
[1]: 0
[2]: 0
Record 26:
Tag: IMAGE::TRANSPARENT_DATA_VALUE
Type: UINT8[3]
Data:
[0]: 0
[1]: 0
[2]: 0
Record 27:
Tag: IMAGE::XY_ORIGIN
Type: FLOAT64[2]
Data:
[0]: 527900.150000
[1]: 5230199.850000
Record 28:
Tag: IMAGE::X_RESOLUTION
Type: FLOAT64[1]
Data:
[0]: 0.300000
Record 29:
```

```
Tag: IMAGE::Y_RESOLUTION
Type: FLOAT64[1]
Data:
[0]: 0.300000
Record 30:
Tag: IMAGE::WKT
Type: ASCII[1]
Data:
[0]: PROJCS["NAD83 / UTM zone 10N",GEOGCS["NAD83",DATUM["North_American_Datum_1983",
        SPHEROID["GRS 1980",6378137,298.2572221010002,AUTHORITY["EPSG","7019"]],
        AUTHORITY["EPSG","6269"]],PRIMEM["Greenwich",0],UNIT["degree
        (supplier to define representation)",0.01745329251994328]
        ,AUTHORITY["EPSG","4269"]],PROJECTION["Transverse_Mercator"],
        PARAMETER["latitude_of_origin",0],PARAMETER["central_meridian",-123],
        PARAMETER["scale_factor",0.9996],PARAMETER["false_easting",
        500000],PARAMETER["false_northing",0],UNIT["metre",1,
        AUTHORITY["EPSG","9001"]],AUTHORITY["EPSG","26910"]]
```

Appendix B: File Sizes and Memory Usage
Calculating memory usage

The amount of memory that GeoExpress uses to perform operations depends on the following factors:

- The image manipulation operations that you perform.
- The operating system.
- The image input format.
- The number of bands in the output image.
- The number of threads and concurrent jobs.
- The strip height and block size.

Of these factors, you can control the strip height and the block size that GeoExpress uses.

Memory usage is constant over the length of the encode operation.

MG3 and MG4 memory usage

The following formula describes the approximate amount of memory used by GeoExpress to compress a single image to the MrSID Generation 4 (MG4) or MrSID Generation 3 (MG3) format:

```
Memory = ((8 + 4 × BlockSize + MIN(StripHeight, BlockSize)) × 4 +
    StripHeight) × NumBands × Width
```

The following list describes the variables used by the formula:

- `Memory` is the estimated memory usage in bytes.
- `BlockSize` is set by the user with the `-blocksize` switch (See Advanced encoding options on page 24.)
- `MIN(StripHeight, BlockSize)` evaluates the values for the strip height and block size and equals whichever value is smaller.
- `StripHeight` is set by user with the `-stripheight` switch (See Advanced encoding options on page 24 and JPEG 2000 encoding on page 58.)
- `NumBands` is the number of bands in the image to be encoded–typically 1 or 3.
- `Width` is the width of the input image in pixels.

MG2 memory usage

The following formula describes the approximate amount of memory used by GeoExpress to compress a single image to the MrSID Generation 2 (MG2) format:

```
Memory = ((8 + 4 × BlockSize + 64) × NumBands × Width × 4) +
    (0.005 × ExpectedOutputFileSize)
```

- `Memory` is the estimated memory usage in bytes.
- `BlockSize` is set by the user with the `-blocksize` / `-bs` switch.
- `NumBands` is the number of bands in the image to be encoded–typically 1 or 3.
- `Width` is the width of the input image in pixels.
- `ExpectedOutputFileSize` is the target file size.

How mosaic sizes are calculated

The size of a mosaic is calculated from the "nominal size" of the output mosaic, which is **not** the same as the file size.

For raster images, the nominal size is the product of the output image width, the image height, the number of bands, and the number of bytes per band. The nominal size assumes that all portions of the image include valid data, whether or not this is the case. (No-Data areas, areas outside a cropped image, and gaps between tiles are not considered part of the image, and areas of overlap are only counted once as part of the image.)

For LiDAR point clouds, the nominal size is a measure of the number of points in the point cloud and the number of fields for each point.

As a result, the size is not adjusted for the presence of transparency regions in the mosaic, such as when:

- a mosaic of non-contiguous images is created
- the output image for a contiguous mosaic does not conform to a rectangular shape

In these cases, the transparency regions in the output image are included in the mosaic size. Also in these cases, the estimated output file size may be considerably larger than the actual output file size.

> **NOTE:** The cost charged to the data cartridge is not always equal to the mosaic size. It is calculated from the sum of the nominal sizes of the input tiles rather than from the nominal size of the resulting mosaic.

Calculating MrSID Area of Interest weight

GeoExpress calculates the resultant image filesize as part of the encoding process, taking into account the user-defined compression ratios for inside and outside the Area of Interest. Selecting the **Weight** option allows you to specify **Lossless** compression or to set a target **Compression Ratio** for the Area of Interest. (The outside area will be encoded at the compression ratio specified in the job options.)

As an example, consider a 1-band (grayscale), 8-bit input image measuring 1000 × 1000 pixels. The user specifies compression for this image at 100:1. An Area of Interest measuring 100 × 100 pixels is then defined within the image, and the compression ratio inside the Area of Interest is set at 10:1.

100 x 100 AOI to be compressed at 10:1

1000 x 1000 image to be compressed at 100:1
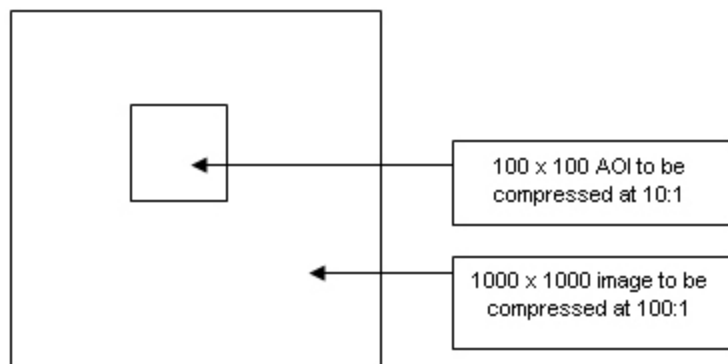
Based on these dimensions and specifications, GeoExpress makes the following calculations:

AOI compression ratio (CR_{AOI}) = 10
Base compression ratio for the image (CR_{other}) = 100
Area of the entire image ($Area_{total}$) is 1000 × 1000 pixels = 1,000,000 pixels
Area of the AOI ($Area_{AOI}$) is 100 × 100 pixels = 10,000 pixels
Area of the portion of the image surrounding the AOI ($Area_{other}$) is 1,000,000 pixels - 10,000 pixels = 990,000 pixels

GeoExpress then makes the following filesize calculations:

Filesize of the AOI (FS_{AOI}) = $Area_{AOI}$ / CR_{AOI} = 10,000 / 10 = 1000 bytes
Filesize of the "outside" (FS_{other}) = $Area_{other}$ / CR_{other} = 990,000 / 100 = 9900 bytes
Total filesize (FS_{total}) = FS_{AOI} + FS_{other} = 1000 + 9900 = 10,900 bytes

GeoExpress then calculates the overall compression ratio:

Compression ratio = $Area_{total}$ / FS_{total} = 1,000,000 / 10,900 = 91.73

In order to calculate the overall target filesize for the encode process the compression ratio for the overall image is set to 91.73. The target filesize thus becomes:

1,000,000 / 91.73 = 10,901 bytes

NOTE: The filesize of the output is reported in the Creating and viewing logs on page 22.

Appendix C: Data Cartridges and Floating Licenses

Data cartridges

GeoExpress uses the Express Cartridge Manager (ECM) to meter the amount of encoding performed.

> **NOTE:** GeoExpress Unlimited version does not us a data cartridge.

ECM options

The following table describes options to be used in managing your data cartridge.

SWITCH	VALUE	NOTES
`-localecm`		Specifies the use of the locally installed Express Cartridge Manager (ECM).
`-netecm`	string	Specifies a network Express Cartridge Manager (ECM) to use, in the form `<host name>:<port>` (e.g. `JohnsComputer:1234`)
`-ecmid`		Displays the Express Cartridge Manager ID and available data cartridge units. The ECM ID is required for ordering new data cartridges.

Cartridge deductions

The data size deducted for an encode operation is approximately equal to the "nominal size" of the image. That is:

```
width × height × number of bands × bytes per sample
```

Note that the nominal size does not include areas of No-Data, so this equation yields a maximum nominal size.

For mosaics, the cost is approximately equal to the sum of the individual tiles—not the nominal size of the resulting mosaic. Optimizing operations do not decrement the data cartridge.

> **NOTE:** Because the charge is based on the nominal size of the image rather than the physical input file size, the encoding of compressed images such as JPEG deducts the cartridge by the same amount as the encoding of input images that are not compressed.

For more information, see Frequently Asked Questions on page 93.

To order data cartridges, visit https://www.lizardtech.com/sales/purchase/.

Floating licenses

Floating licenses enable a user on a networked computer to lease or "check out" a GeoExpress license for the period of time they are working. When the user exits the program, the license is returned to the License Server and available for another user.

On Windows, the LizardTech License Server runs as a service named `LizardTech License Server`.

Windows

Install the License Server

1. Download the LizardTech License Server from the LizardTech website.
2. Run `setup.exe`.
3. Follow the wizard steps to install the license server.
   When installation is complete, the License Server Utility will start. You can request a license immediately, or follow the steps below to add a license at anytime.

> **NOTE:** For additional information on the setup and usage of LizardTech License Server, see the SentinelLM System Administrator's Online Guide installed with your License Server.

Request a License

1. Click **Start > LizardTech > Add Floating License**.
   This starts the License Server Utility.
2. Click **Request a License**.
   This will open your web browser to the LizardTech Product Activation page.
3. Enter the requested information and click **Submit**.

   - For LizardTech Product, select **GeoExpress**.
   - Select **New License**.
   - Paste your locking code.
   - Use the **Additional Information** field to give any additional information about your license usage. For example, if you have purchased 10 floating licenses but need to deploy them among multiple locations, let us know how you will distribute these ("2 licenses for our Portland office, 3 for Seattle, and 5 for London.") This way we can send you the license files you need for each location.

   Within about one business day you will receive an email from LizardTech Support that includes your license file. Save this file on the system where you installed the License Server.

Add a License

1. Click **Start > LizardTech > Add Floating License**.
2. Click **Import**.
3. Navigate to and select the downloaded license file (`*.lic`), then click **Open**.
   The License Server Utility will validate the license and display what type of license you imported.
4. Click **Add License** to add your new license to the license server.
5. Click **Done** to exit the License Server Utility.

Linux

Adding Floating Licenses under Linux

Once you have installed the License Server you must acquire a license code from LizardTech. A license code is required for each License Server you add to your network.

To add a license for a License Server on Linux:
1. Run the `echoid` file to display your locking code. On Linux this file is located by default in `/usr/local/LizardTech/LicenseServer/licenseserver/`.
2. Record the value returned by `echoid`, then visit https://www.lizardtech.com/support/product-activation/.
3. Enter the requested information and click **Submit**.

    - For LizardTech Product, select **GeoExpress**.
    - Select **New License**.
    - Paste your locking code.
    - Use the **Additional Information** field to give any additional information about your license usage. For example, if you have purchased 10 floating licenses but need to deploy them among multiple locations, let us know how you will distribute these ("2 licenses for our Portland office, 3 for Seattle, and 5 for London.") This way we can send you the license files you need for each location.

    You will receive a response from LizardTech within one business day.
4. When you receive your license code, run the `lslic` file in the same Tools directory:
    Open a command line interface and enter `lslic -A "license code"` (where `license code` is the code given to you by LizardTech; note that the quotes are required).

You can manually add the locking code to the file `/usr/local/LizardTech/LicenseServer/licenseserver/lservrc`.

To manually start the License Server, run the `./lserv` utility.

While using LizardTech License Server on a UNIX platform, you must be logged in as root to:
- Start the License Server
- Change distribution criteria (for redundant servers)
- Shut down the License Server
- Turn license server logging on and off
- Turn token borrowing on and off
- Add or delete license servers from the redundant license server pool

Only the user who started the license server can stop the license server. It is strongly recommended that only the root user administer the license server.

Select a license server

In most cases, you will not be aware of the floating license leasing process because it will occur invisibly and automatically. If you need to, you can choose to connect to a specific license server.

To specify a preferred License Server:
1. Choose **Options > Licensing**.
    This opens the **License and Cartridge Management** dialog.
2. Enter the IP address or network name of the license server.
3. Click **OK**.

Server Administration

Configuring floating and commuter licenses

As the license server administrator, you may control the percentage of available floating license seats that can be used as commuter licenses. That is, the number that can be checked out and used without a connection to the network.

To configure licenses, set your `LSERVOPTS` system environment variable with the following:

```
-com <percentage>
```

where `<percentage>` is an integer between 0 and 100. Do not include a percent sign. This percentage value determines the number of licenses that can be checked out as commuter licenses.

For example, specifying `-com 0` ensures that no floating licenses can be checked out as commuter licenses, while specifying `-com 100` ensures that all floating licenses may be checked out as commuter licenses.

> **NOTE:** The percentage value rounds down so that, for example, specifying `-com 50` on a server that has 3 licenses allows only 1 license to be checked out as a commuter license.

> **WARNING:** This environment variable affects all application licenses your license server is serving out, whether for GeoExpress or other applications. This means users of other software applications whose licenses you are administrating through your license server can be affected. For example, suppose you have 4 licenses for GeoExpress and you want to make 2 of them available for commuting. Suppose also that you have 1 license for Acme Supersoft. Specifying `-com 50` will make half of your GeoExpress licenses available as you planned but will have the additional side effect of restricting your Acme Supersoft license from being checked out (50% rounded down of one license is 0).

Utilities

Several utilities are available to help server administrators manage the LizardTech License Server on their network. By default these tools and their documentation are installed from the GeoExpress DVD when you install the License Server.

> **IMPORTANT:** The License Server should be installed on the same subnet as any clients who wish to access it. If your License Server is not installed on your local subnet, you will be prompted to specify the name of the computer you wish to connect to for a floating license in the **GeoExpress Licensing** dialog.

Following are descriptions of other utilities included in GeoExpress that administrators are likely to need to access and use. For more information on these utilities and on others not listed below, see the SentinelLM System Administrator's Online Guide installed with your License Server.

UTILITY	PLATFORM	DESCRIPTION
echoid	All	Generates a locking code.
lserv	Linux	Starts the server (requires administrator rights).
lservnt	Windows NT	Starts or stops the server (see the SentinelLM System Administrator's Online Guide for parameters).
loadls	Windows NT	Loads the License Service into NT Services.
WinAdmin.exe	Windows	Displays a list of servers and licenses.
lsrvdown	All	Stops the server (requires administration rights).
lslic	All	Adds a license to your license file.
lsmon	All	Monitors license server transactions.
lswhere	All	Displays a list of license servers.

Using floating licenses
Using floating licenses on a network
In most cases, you will not be aware of the license check-out process because it will occur invisibly and automatically (see Select a license server on page 90).

> **IMPORTANT:** When using floating licenses a constant connection to the license server is required to perform encodes. If network connectivity is lost, encodes will fail.

Using commuter licenses
A commuter license is a floating license that has been disconnected from the network. If you are using a portable (laptop) computer, as for traveling purposes, you can check out a license from a license server on your network and then disconnect from the network. You can then use GeoExpress to encode images, no matter where you go, even out of the country.

> **NOTE:** You must have purchased the Floating License option for GeoExpress in order to use commuter licenses. For more information, contact your LizardTech representative (https://www.lizardtech.com/sales#retail-sales).

To check out a commuter license, run the appropriate commuter utility as shown in the table below. These utilities ship with GeoExpress. Instructions for using them are given below.

> **IMPORTANT:** You must check in a commuter license when you are through using it (see instructions for each utility below). If you leave a license checked out after you are finished using it, it remains unavailable for other users.

ON THIS PLATFORM	USE THIS UTILITY
Windows	`ltcommute.exe`
Linux	`lcommute`

LizardTech's Commuter Licensing utility
Use the Commuter Licensing utility for Windows as an alternative to `lcommute` or `ltcommute`.

To check out a license using LizardTech's Commuter Licensing utility:
1. Choose **Start > Programs > LizardTech > GeoExpress > Commuter Licensing**.
   You can also run the executable `wcommute.exe`.
2. Click **Single Server** and specify a server name, then click **OK**.
   You can also click **Search Subnet** to display available licenses.
3. Select a license and click **Check Out**. The license is now marked with a red check.

To check in a license using the Commuter Licensing utility:
1. Choose **Start > Programs > LizardTech > GeoExpress > Commuter Licensing**, or type `wcommute.exe` at a command prompt.
2. Click **Single Server** and specify a server name, then click **OK**.
   You can also click **Search Subnet** to display available licenses.
3. Select the license (it will be marked with a red check when it is checked out) and click **Check In**. The license becomes unmarked and is now available for another user.

ltcommute (or ltcommute.exe)

On Windows, use the `ltcommute` utility.

To check out a license using `ltcommute` use the following command:

```
-co -s <server> -fn <feature name> -fv <feature version>
```

To check a license back in using `ltcommute` use the following command:

```
-ci -s <server> -fn <feature name> -fv <feature version>
```

lcommute (or lcommute.exe)

Use the `lcommute` utility for Linux platforms.

The `lcommute` utility can be used either with parameters or interactively. To operate interactively, specify no arguments at the command line (for more information see the System Administrator's Online Help, distributed on your GeoExpress DVD-ROM).

To check out a license using `lcommute` use the following command:

```
-c o -o n -s <server> -f <feature> -v <version> -d 0
```

> **IMPORTANT:** Zero (0) must be used with the `-d` argument.

To check a license back in using `lcommute` use the following command:

```
-c i -0 n -s <server> -f <feature> -v <version>
```

Using Terminal Services

If you wish to use GeoExpress in a Terminal Services environment, you must use a floating license.

Frequently Asked Questions
Questions about Data Cartridges

For more information see Data cartridges on page 88, Licensing GeoExpress on page 10, and Installing data cartridges on page 12.

What are data cartridges?

Data cartridges are small, binary encrypted files that enable you to encode images with GeoExpress. Cartridges are a software-based replacement for the traditional physical dongle or hardware lock. They are generated by LizardTech, based upon your system ID, and then emailed to you as an attached file.

How does a data cartridge work?

Data cartridges are installed through the GeoExpress user interface. The user interface displays the amount of data in the installed cartridge and the amount of 'encoding' capacity remaining on the cartridge. The data cartridge is decremented based on the amount of input data calculated by multiplying the number of pixels to be encoded times the pixel depth.

What raster operations get charged against the cartridge?

For raster jobs, only the initial creation of MrSID and JPEG 2000 images charges the cartridge. Working with images that are already in the MrSID or JPEG 2000 format does not decrement the data cartridge. For instance, you can create a lossless MrSID or JPEG 2000 file, which decrements the cartridge, and then use that file to create visually lossless compressed MrSID or JPEG 2000 files that do not charge against the cartridge. Additionally, updating mosaics and creating mosaics of existing MrSID or JPEG 2000 files do not charge against the cartridge.

What LiDAR operations get charged against the cartridge?

For LiDAR jobs, the following operations charge the data cartridge:

- Creating a MrSID image from any other file format. However, creating a MrSID image from another MrSID image does not charge the data cartridge.
- Creating a LAZ image from a LAS image or a LiDAR text file. However, creating a LAZ image from another LAZ image does not charge the data cartridge.
- Creating a LAS image from a LiDAR text file.

If you have an input MrSID image, you can decode the image to LAS or LAZ without charging the data cartridge.

Can I share my data cartridge with other users in my organization?

Yes. GeoExpress has a server-based shared capacity cartridge. This is NOT a floating license (for floating license information see below) but rather a "big bucket" of capacity that can be accessed by multiple licensed users on the network.

Questions about Floating Licenses

For more information see Licensing GeoExpress on page 10 and Floating licenses on page 88.

How do I specify a License Server?

Enter the License Server IP address or network name in the **Licensing** section of the **License and Cartridge Management** window. To access this window, choose **Options > Licensing**.

Which license takes precedence when there are more than one available?

When you run GeoExpress after the temporary license has expired, the program first looks for a valid standalone (local) license on your computer. If there is none, it looks for a valid floating license by trying to connect to a license server on your local subnet. If it cannot find one you are prompted to either activate a permanent standalone license or specify a license server on your local subnet or a broader network.

Appendix D: Troubleshooting
Installation problems

Following are descriptions of several problems that could be encountered installing GeoExpress.

Invalid License Code Entered

The license code was entered incorrectly.Try re-entering it; choose **Options > Licensing** to open the **License and Cartridge Management** dialog.

The most reliable way to add the license is to import the license file. You should have received this file (with the extension `.lic`) in an email from LizardTech. In the **License and Cartridge Management** dialog, click **Import** next to the **License** field and select the `.lic` file.

If you still receive this error, you can edit the license file manually. The license code is stored in the `GeoExpress\bin` directory in a file called `lservrc`. Open this file with a text editor and compare the 51-character license code with the one you received from LizardTech. The code in the `lservrc` file can be corrected manually, if necessary. The number sign (#) character at the end of the license code indicates the end of the code. Although this character is not required for the license to be considered valid, it is useful for making sure that you have copied the string completely, and we recommend that you leave it in.

License Suddenly Not Recognized

The permanent license that you received from LizardTech is keyed for a unique network card identification number. If the network connection becomes unavailable or your network hardware configuration has changed, the program may not accept the license code. Restore the network connection or the original network hardware configuration, or fill out the form at https://www.lizardtech.com/support/product-activation/ for a new permanent license.

License Timed Out Early

If you have a temporary version of GeoExpress and the clock in your operating system has been altered–for instance, if you have recently upgraded your system software–security features in the licensing software may not allow the program to run. Please contact technical support at https://www.lizardtech.com/support.

Encoding problems

If you set a low weight value for an image with low color contrast, you may notice the following pattern of light and dark spots across your image:
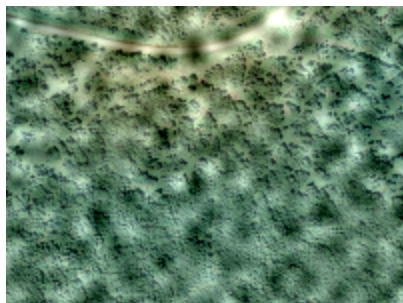
The following factors contribute to the creation of this pattern:

- Low weight value
- High compression ratio
- Low color contrast
- MrSID Generation 2 output format
- Image enhancement

To reduce the appearance of this pattern, use the `-weight` flag to set a higher value for the weight. For example, you might change the weight value from 2 to 3.

Finding your version and build numbers

You may need to know your the version and build number of your GeoExpress software in order to communicate with LizardTech Support. To find these numbers, use the `-version` switch as follows:

```
mrsidgeoencoder -version
```

This will return several lines that may look like this:

```
Using commuter license issued from server: 10.0.17.5
Version 10.0.0.1234.default (64-bit) (Nov 15 2017, 03:14:16)
```

In this case, the version number is **10.0.0** and the build number is **1234**.

Technical Support

Most technical issues can be resolved using the various resources you have available. In addition to the product documentation and the "Read Me" file, LizardTech offers a knowledge base and product updates on the LizardTech website.

Knowledge Base

The LizardTech Knowledge Base contains articles about known technical and usage issues and is frequently updated.

https://www.lizardtech.com/support/geoexpress/knowledge-base

Product updates

Updated versions of LizardTech viewer tools are available for download at no cost.

https://www.lizardtech.com/support/geoexpress/installers

Support plans

Protect your investment in LizardTech software by participating in a LizardTech support plan. For more details, please contact your regional LizardTech office.

https://www.lizardtech.com/sales#retail-sales

Contacting Technical Support

To contact LizardTech Technical Support, visit http://www.lizardtech.com/support.

The support page includes links to the LizardTech Knowledge Base and the Product Activation page. A Contact Form is also provided for issues that require further assistance.

In an emergency, call 206-902-2845 between the hours of 8 AM and 5 PM Pacific Time.

Please have the following information available to assist in resolving your problem:

- The task you were working on when the problem occurred
- The command you typed prior to the problem, if applicable
- The exact error message, if applicable
- The type of file you are encoding and the file size
- Whether you have restarted the computer and attempted to reproduce the problem
- Which version of GeoExpress you are running (see Finding your version and build numbers on the previous page).
- Other LizardTech products you have installed
- The operating system
- The amount of hard drive space available
- The amount of memory installed in your system
- Any other information you feel is relevant

Appendix E: Company and Product Information
About LizardTech

Since 1992, LizardTech has delivered state-of-the-art software products for managing and distributing massive, high-resolution geospatial data such as aerial and satellite imagery and LiDAR data. LizardTech pioneered the MrSID® technology, a powerful wavelet-based image encoder, viewer, and file format. LizardTech has offices in Seattle, Portland, and Tokyo and is a division of Celartem, Inc. For more information, visit https://www.lizardtech.com.

Other LizardTech products

Thank you for using LizardTech® GeoExpress® software. Try the rest of our product line.

GeoViewer
Efficient Viewing and Exporting of MrSID and JPEG 2000 Layers

GeoViewer is LizardTech's free, standalone application for viewing geospatial imagery, vector overlays and LiDAR data. GeoViewer enables you to combine, view and export visual layers from varied sources, such as local repositories, Express Server catalogs, and WMS and JPIP servers. GeoViewer supports a wide range of input formats and exports to GeoTIFF, PNG and JPEG. It's the most efficient means of viewing MrSID and JPEG 2000 images.

For more information about GeoViewer, visit https://www.lizardtech.com/geoviewer-pro/overview.

Express Server
Image Delivery Software for Geospatial Workflows

LizardTech Express Server software is the best solution for distributing imagery in MrSID or JPEG 2000 format. With Express Server, users on any device access imagery faster, even over low-bandwidth connections. Express Server is faster, more stable and easier to use than any other solution for delivering high-resolution raster imagery.

For more information about Express Server, visit https://www.lizardtech.com/express-server/overview.

MrSID Decode SDK
Integration of MrSID Support into Third-Party Applications

The MrSID Decode SDK provides a framework for extracting raster or LiDAR data from MrSID files, including MrSID Generation 4 (MG4™). Used as the foundation for LizardTech's Express Suite® line of geospatial products—GeoExpress, Express Server and Spatial Express software—the MrSID Decode SDK is a robust toolkit suitable for complex application development needs.

MrSID Decode SDK is available for free download: https://www.lizardtech.com/developer/overview.

Appendix F: Command Line Applications and Switches
Switches Listed Alphabetically

The following table lists all of the GeoExpress Command Line switches alphabetically. For switches used with other command line applications included in theGeoExpress installation, see mrsidgeodecode on page 113, mrsidgeoinfo on page 111, and mrsidgeometa on page 119.

SWITCH	VALUE	NOTES
`-alignpixels`		Only for use with `-reprores`. Aligns the output image to an integer multiple of the output resolution. If you reproject an image and change the resolution, you may want to use this switch.
`-alphalossless`		JP2 only. Specifies whether or not the alpha band should be encoded losslessly. Default: `true`
`-alphasource / -as`	string	MG4 only. Specifies how to generate the alpha channel. Accepted values are: `opaque` or `oq`: All input pixels are valid `auto`: Use the nodata value if it is set, otherwise all pixels are valid `<value>`: Specify a transparency value for each band. For 8-bit and 16-bit RGB color and for grayscale images, `<value>` can be specified in the format RRR_GGG_BBB. For multispectral images, `<value>` is specified in the format `<bandlist>@<color>` See Alpha bands and MrSID on page 30 for information on specifying per-band values Default: `auto`
`-aoibottom`	float	Specifies Area of Interest offset from bottom.
`-aoicoord`	string	Sets the coordinate system for Area of Interest to image or geo. Default: `image`
`-aoicr`	float	MG3 and MG4 only. Encodes Area of Interest with a specific compression ratio.
`-aoicxy`	float0 float1	Specifies center XY position of Area of Interest.
`-aoileft`	float	Specifies Area of Interest offset from left.
`-aoilossless`		MG3 and MG4 only. Encodes Area of Interest losslessly.
`-aoilrxy`	float0 float1	Specifies lower right XY position of Area of Interest.
`-aoimaskcolor`	string	Optional switch used in conjunction with the `-aoimaskinner` and `-aoimaskouter` switches to specify the mask color. Acceptable values are: `black`: uses the minimum sample value `white`: uses the maximum sample value RRR_GGG_BBB: uses a custom 8-bit RGB color Default: `black`

SWITCH	VALUE	NOTES
`-aoimaskinner`		Drives the interior area to a single color value (defaults to black). Cannot be used with any other AOI method (`-aoicr`, `-aoilossless`, `-aoishiftinner`, `-aoishiftouter`, `-aoimaskouter`, `-aoiweightinner`, `-aoiweightouter`).
`-aoimaskouter`		Drives the exterior area to a single color value (defaults to black). Cannot be used with any other AOI method (`-aoicr`, `-aoilossless`, `-aoishiftinner`, `-aoishiftouter`, `-aoimaskouter`, `-aoiweightinner`, `-aoiweightouter`).
`-aoinumlevels`	uint	JP2 only. Determines the number of zoom levels that the Area of Interest encoding applies to. Defaults to all zoom levels.
`-aoiright`	float	Specifies Area of Interest offset from right.
`-aoishift`	uint	JP2 only. Used in conjunction with -aoishiftinner or -aoishiftouter. Sets an optional shift value to be used with either the "shift inner" or "shift outer" Area of Interest methods.
`-aoishiftinner`		JP2 only. Preserves quality in the interior Area of Interest.
`-aoishiftouter`		JP2 only. Preserves quality in the exterior Area of Interest.
`-aoitop`	float	Specifies Area of Interest offset from top.
`-aoiulxy`	float0 float1	Specifies upper left XY position of Area of Interest.
`-aoivectoroverlay / -aoivo`	string	Specifies an Area of Interest using a vector overlay file. Supported vector overlay formats include: Esri shapefile (`*.shp`) MapInfo (`*.tab`) GML (`*.xml`)
`-aoivectorlayer / -aoivol`	sint	Specifies the zero-based layer within a vector overlay file to use for an Area of Interest operation. The default layer is the first layer in the file.
`-aoiweightinner`	uint	JP2 only. Encodes the interior area with a given weight value.
`-aoiwieghtouter`	uint	JP2 only. Encodes the exterior area with a given weight value.
`-aoiwh`	float0 float1	Specifies width and height of Area of Interest.
`-applyRotation`	boolean	True or false. For images that include rotation metadata, GeoExpress creates rotated output images. True is the default value. If you do not use this switch, GeoExpress creates rotated images by default.
`-applyRPC`		Applies the orthorectification described in the NITF RPC metadata to the image.
`-as`		See -alphasource / -as on the previous page.
`-bandList / -b`	string	MG4 only. A comma-separated list specifying the bands to decode.

SWITCH	VALUE	NOTES
-bandsselection / -bands	string	Specifies the bands to extract from the source image and their order in the output image. Number of bands must agree with the target colorspace (for grayscale images a single band must be specified, for RGB images 3 bands, for CMYK images 4 bands). Band numbering starts at 1. REMAINDER specifies "all the other non-alpha bands". Default: REMAINDER Example: `-colorspace RGB -bandselection 5,3,2`
-bitsofprecision / -bop	uint	JP2 only. Enables you to choose how many significant bits are to be used from the samples of the source imagery. For example, an image may consist of 16-bit data values, but only eleven of those bits may be meaningful. By default full precision is used.
-blocksize / -bs	sint	**Important:** Block size affects the use of system resources. For information on block size for raster files see Advanced encoding options on page 24. For information on block size for LiDAR files, see MG4 LiDAR switches on page 57.
-blueband	string	Specifies the blue band component of a color composite input image file.
-blueseg	uint	Used in conjunction with the -blueband switch to identify which image segment of a multisegment input image to use
-bop		See -bitsofprecision / -bop above.
-bs		See -blocksize / -bs above.
-cbs		See -codeblocksize / -cbs below.
-ccmp		See -colorcomp / -ccmp below.
-ccmpseg		See -colorcompseg -ccmpseg below.
-cmos		See -croppedmosaic / -cmos on the next page.
-codeblocksize / -cbs	sint0 sint1	JP2 only. Specifies the width and height (in pixels) of the codeblocks used to encode the image. Default: 64 **Note:** for JP2 codeblock size restrictions, see JPEG 2000 encoding on page 58.
-colorcomp / -ccmp		Identifies the input file as a formatted text file containing component bands to be used for creating a color composite image.
-colorcompseg -ccmpseg	string	Used in conjunction with the `-colorcomp` switch to identify which image segments to use if the input images support multiple image segments. Segments are numbered 1 through n and specified by a comma delimited list with no spaces.
-colorspace / -cs	string	Specifies the target colorspace. Valid values are `rgb`, `cmyk`, `gray`, `multi` and `same`. Target colorspace must agree with the number of bands in the -bandsselection / -bands above argument. Default: `same` Example: `-colorspace RGB -bandselection 5,3,2`

SWITCH	VALUE	NOTES
`-colortransform`		Specifies that RGB (YIQ) Color Transform should be applied to first three bands in a multispectral image. Set to `true` only if first three bands are R, G and B in that order. Default: `false`
`-composite`		Identifies the output file as a composite mosaic. The input must be a mosaic list file (with extension `.mos`), containing a list of MG3 or MG4 files that make up the mosaic.
`-compressionratio / -cr`	float	Cannot be used with the `-perbandgroupcompressionratio` switch. For LiDAR files, specifying a compression ratio may cause GeoExpress to remove points to reduce the file size. Specifies how much compression is applied to an encoded file. This number is interpreted as a ratio, so a compression ratio of 20 will produce a file that is twenty times smaller than the nominal uncompressed size of the input file. Example: `-cr 10`
`-convertto8bit`		Converts incoming unsigned 16-bit data to unsigned 8-bit data during encoding. The switch gets ignored for input data that is not unsigned 16-bit.
`-coordspace / -coord`	string	Sets the coordinate system for cropping to `image` or `geo`. Default: `image` (pixels).
`-cr`		See -compressionratio / -cr above.
`-cropbottom`	float	Specifies crop region offset from bottom.
`-cropcxy`	float0 float1	Specifies center XY position of a cropping rectangle.
`-cropleft`	float	Specifies crop region offset from left.
`-croplrxy`	float0 float1	Specifies lower right XY position of a cropping rectangle.
`-croppedmosaic / -cmos`		Identifies the input file as a text file of mosaic images with cropping offsets.
`-cropright`	float	Specifies crop region offset from right.
`-croptop`	float	Specifies crop region offset from top.
`-cropulxy`	float0 float1	Specifies upper left XY position of a cropping rectangle.
`-cropvectorlayer / -cropvol`	sint	Specifies which layer in the file is to be used for cropping.
`-cropvectoroverlay / -cropvo`	string	Specifies the overlay file to be used for cropping.
`-cropwh`	float0 float1	Specifies width and height of a cropping rectangle.
`-cs`		See -colorspace / -cs on the previous page.
`-despeckle / -ds`	bool	Minimizes speckling effects in the no-data regions of newly created MG3 and MG4 and JPEG 2000 (GMLJP2) images. Accepted values are: 　`true`: apply despeckling 　`false`: do not apply despeckling Default: `false`

SWITCH	VALUE	NOTES
-despeckleonly / -dsonly		Minimizes speckling effects in the not data regions of existing MG3 and JPEG 2000 images. Use this option to despeckle existing imagery without reencoding it.
-dsspacing	uint	Specifies the point spacing in the outline of the despeckling mask. Common values are 6-12. Lower values mean more points and more rigidly defined outline.
-dsthreshold	uint	Specifies the despeckling threshold. All pixel values below the despeckling threshold will be used in the despeckling process. For example, with a threshold value of 10, GeoExpress treats any border pixels with a value less than 10 as no-data pixels. Valid values are 1-127.
-eaux		Specifies that an Esri Aux file should be generated with the output.
-ecmid		Displays the Express Cartridge Manager (ECM) ID and available Data Cartridge units.
-flatten		MG3 and MG4 only. Flattens a composite mosaic.
-flattensize	sint	MG3 and MG4 only. Used with -flatten switch to specify a flattening tile size. Larger values may improve the speed of the flattening operation at the expense of memory.
-flushperiod / -flush	uint	JP2 only. Enables codestream flushing, measured in rows of pixels. When codestream flushing is enabled, less memory may be required to encode the image. The flush period should be on the order of the strip height being used. Using the flush period should not significantly affect output image quality. Default: 4096.
-frequencybalance	float	MG3 and MG4 only. Affects the visual emphasis given to edges and flat color areas of the image. A lower setting creates more defined edges, while a higher setting creates softer edges. Acceptable values: 0.0-10.0. Default: 2.0.
-fromepsg	sint	Specifies the EPSG code describing the input image's coordinate reference system.
-fromwkt	string	Specifies a text file containing a WKT that describes the input image's coordinate reference system.
-fs	string	See -targetsize / -fs on page 109.
-gamma	float	MG2 only. Changing the gamma value will affect the visual emphasis given to edges and flat color areas of the image. A lower setting creates more defined edges, while a higher setting creates softer edges. Acceptable values: 0.0-10.0. Default: 2.0.
-gmljp2coveragemetadata	string	JPEG 2000 (GMLJP2) only. Specifies an XML file that contains GMLJP2 coverage metadata.

SWITCH	VALUE	NOTES
`-gmljp2datafile`	string	JPEG 2000 (GMLJP2) only. Specifies a binary file that contains custom GMLJP2 data. Can only be used in conjunction with the `-nogmljp2` option.
`-greenband`	string	Specifies the green band component of a color composite input image file
`-greenseg`	uint	Used in conjunction with the `-greenband` switch to identify which image segment of a multisegment input image to use
`-h / -?`		Displays a short usage message.
`-help`		Displays a detailed usage message.
`-i`		See -input / -i below.
`-if`		See -inputformat / -if below.
`-ignoreworldfile / -ignorewf`		Specifies that GeoExpress should ignore georeferencing from input world files.
`-imageenhancement`		MG2 only. Applies a dithering algorithm which may improve the visual quality of photographic imagery.
`-imagesegments / -iseg`	string	Used in conjunction with the `-input` switch to identify which image segments to use if the input image supports multiple image segments.
`-input / -i`	string	Identifies the input source file. It can be a full path name, or a path that is relative to the current working directory. Example: `-i foo.tif`

`-inputformat / -if`	string	Identifies the input file format. Accepted formats for raster are:
		  `tif` or `tiff`: TIFF 6.0
		  `tifw`: TIFF 6.0 with TIFF world file
		  `tifg` or `geotiff`: GeoTIFF
		  `bbb`: BIP, BIL or BSQ format
		  `doq`: Digital Orthophoto Quadrangle (DOQ)
		  `doq_nc`: DOQ (no clipping)
		  `ras` or `rast`: Sun Raster
		  `lan`: ERDAS LAN
		  `sid` or `mrsid`: MrSID
		  `jpg` or `jpeg`: JPEG (not JPEG 2000)
		  `jp2`: JPEG 2000
		  `bmp`: Bitmap (BMP) (Windows only)
		  `nitf`: National Imagery Transmission Format 2.0 and 2.1 (NITF)
		  `img`: ERDAS Imagine
		  `ecw`: ECW
		Accepted formats for LiDAR are:
		  `las`: LAS format
		  `laz`: LAZ format
		  `sid`: MrSID Generation 4 (MG4) LiDAR format
		  `txt`: LiDAR text file

`-iseg`		See -imagesegments / -iseg above.

SWITCH	VALUE	NOTES
-kweight	float	MG3 only. Affects emphasis of the K band for CMYK images. A higher setting increases emphasis, while a lower setting increases the consistency of color between the compressed image and the original data. Acceptable values: 0.0-10.0. Default: 0.25.
-localecm		Specifies the use of the locally installed Express Cartridge Manager (ECM).
-log	string	Directs program output to log file with specified name.
-lossless		MG3, MG4 and JP2 only. Preserves all of the pixel data of the original source image. See Lossless encoding on page 17 for more information.
-maxlevels		Creates an output file with the maximum number of zoom levels that the input image supports.
-metadatafile	string	Specifies a text file containing user metadata tags.
-mosaic / -mos		Identifies the input file as a mosaic list. For raster mosaics, the file must have a .mos extension. For LiDAR files, the file must have a .list extension. (Optional; if omitted, a flat mosaic file will be created if the input is a .mos or .list file.) Do not use with -composite.
-ms		See -multisegment / -ms below.
-msmosaic / -msmos		Identifies the input file as a text file of mosaic images with comma delimited image segment identifiers. Each line of the text file must contain the input file name, followed by a comma and then a comma delimited list of the active image segments.
-multires		MG3, MG4 and JP2 only. Enables multiresolution support for mosaic operations.
-multiresample	string	Sets the resampling method for a multiresolution mosaic. Accepted values are: 　nearest: nearest neighbor resampling 　bilinear: bilinear resampling 　bicubic: bicubic resampling Default: nearest
-multiresres	float0 float1	MG3, MG4 and JP2 only. Specifies the x and y resolutions for a multiresolution mosaic.
-multisegment / -ms		NITF only. Specifies the creation of a NITF file with multiple image segments.
-netecm	string	Specifies a network Express Cartridge Manager (ECM) to use, in the form <host name>:<port> (e.g. JohnsComputer:1234)
-nitfmetadata	string	Specifies a formatted text file that describes various NITF 2.1 metadata fields.
-nocolortransform		MG4 only. Specifies the omission of the default color transform for the first three bands of an image with three or more bands. Use this switch if the first three bands are not R, G and B.

SWITCH	VALUE	NOTES
`-noembedschemas`		JP2 only. Specifies that GMLJP2 schemas should not be embedded in the output file.
`-nogmljp2`		JP2 only. Specifies that GMLJP2 metadata should not be included. See About GML and GMLJP2 on page 65.
`-nonoptimizable`		MG3 and MG4 only. Specifies that the target MrSID file cannot be optimized at a later date.
`-nopltmarkers / -noplt`		JP2 only. Disables packet length markers.
`-noprecincts / -noprec`		JP2 only. Specifies disabling precincts.
`-numThreads`	int	The number of threads that you want to use for the encoding operation. See Advanced encoding options on page 24.
`-onepass`		MG3 only. Specifies the use of the one-pass optimizer instead of the two-pass optimizer.
`-orsrs`		See -overrideSRS / -orsrs on the facing page.
`-otg`		See -outputtilegrid / -otg below.
`-otm`		See -outputtilemag / -otm below
`-output / -o`	string	Identifies the name of the file that GeoExpress creates. It can be a full path, or a path that is relative to the current working directory. Example: `-o myfile.sid`
`-outputformat / -of`	string	Identifies the desired output format of the file that is to be encoded. Accepted formats for raster are: 　`mg2`: MrSID Generation 2 (MG2) 　`mg3`: MrSID Generation 3 (MG3) 　`mg4`: MrSID Generation 4 (MG4) 　`gmljp2`: JPEG 2000 (GMLJP2) 　"`jp2`": JPEG 2000 (Part I) 　"`nitf`": raw NITF 　"`nitfjp2`": NITF encoded as JPEG 2000(JP2) 　`tiff`: GeoTIFF Accepted formats for LiDAR are: 　`las`: LAS format 　`laz`: LAZ format 　`mg4`: MrSID Generation 4 (MG4) The default output format for raster and LiDAR files is MrSID Generation 4.
`-outputtilegrid / -otg`	sint0 sint1	The number of rows and columns to split the output files into. Setting this option splits the output file into uniformly sized tiles. The output files use the base output file name appended with a numeric suffix. Only MrSID and JPEG 2000 files are accepted as input. Example: `mrsidgeoencoder -i foo.sid -o bar.sid -otg 2 3`
`-outputtilemag / -otm`	float	Specifies the magnification of the output tiles. Valid values are between 0.0 and 1.0, where 1.0 represents the image at full resolution.

SWITCH	VALUE	NOTES
`-overrideSRS / -orsrs`	string	The EPSG or well-known text (WKT) string to use for the source file. Enter an EPSG code in quotes or specify a file that contains a WKT.
`-password / -pw`	string	MG2 and MG3 only. Encrypts image with a password. Only image data is encrypted, not metadata.
`-perbandgroupcompressionratio / -pbgcr`	string	Cannot be used with `-cr` switch. Specifies compression ratios for groups of (non-alpha) bands in the output image. Applies to multispectral output only. See Setting per-band compression ratios on page 17 for usage and examples.
`-plt`		See -usepltmarkers / -plt on page 110.
`-porder`		See -progressionorder / -porder on the next page.
`-precincts / -prec`	string	JP2 only. Specifies precinct sizes. Precincts are width-height pairs whose use may improve the performance of decode operations for certain image encodings such as those in which tiles are not used. The input format is <w1, h1, w2, h2,...wn, hn> where n is the number of zoom levels in the image. If you specify fewer than n precincts, the last one will be repeated for the remaining levels. Precinct sizes must be powers of two, except for the last one in the list, which has the lowest resolution. By default the use of precincts is enabled. Default for both width and height: 256.
`-profile`	string	JP2 only. Specifies a predefined group of encode settings. Supported named profiles are: 　　`NPJE`: "NGA-Preferred JPEG 2000 Encoding" settings. The NPJE profile sets the values to approximate the preferred parameters of the National Geospatial-Intelligence Agency (NGA) for encoding images for panning and zooming at high resolution. 　　`EPJE`: "Exploitation Preferred JPEG 2000 Encoding" settings. The EPJE profile is optimal for low-resolution browsing among images. 　　`Large`: Uses optimal settings for creating large JPEG 2000 images Default: LizardTech's general purpose JP2 encode settings. These are NOT the same as the GeoExpress default encode settings, which are recommended for large images. See Default JP2 settings on page 63.
`-profilefile`	string	JP2 only. Specifies path to a profile file to use for setting up encode properties. Additional properties set on the command line will override the profile settings.
`-progress`	string	Sets the appearance of progress meter. Acceptable values are none, default and timer.

SWITCH	VALUE	NOTES
`-progressionorder / -porder`	string	JP2 only. Progression order may have a significant impact on the time and memory usage required to encode and/or decode the image. Different progression orders should be used for different target workflows. Valid values are LRCP, RLCP, RPCL, PCRL, and CPRL. Default : RPCL
`-pw`		See -password / -pw on the previous page.
`-qualitylayers / -ql`	uint	JP2 only. Indicates the number of quality layers with which to encode the image. Among other things, quality layers enable better "streaming" (progressive transmission and display) in some applications. Default: 30.
`-quiet / -q`		Suppresses all screen output.
`-rbs`		See -reproblocksize / -rbs below.
`-redband`	string	Specifies the red band component of a color composite input image file.
`-redseg`	uint	Used in conjunction with the -redband switch to identify which image segment of a multisegment input image to use.
`-reproerror`	float	Specifies the desired error fraction for a reprojection operation. Acceptable values: 0.0-1.0. Default: 0.125.
`-removealpha`	string	MG4 and JP2 only.Specifies that the alpha band should be discarded from the source image.
`-removeCustomVLRs`		Omit custom variable length record (VLR) metadata from LAS files. VLR metadata can include vendor-specific data, user-specified data, and more.
`-reproblocksize / -rbs`	sint	Sets the reprojection blocking value. Use smaller values for larger images. Default: 512.
`-reproerror`	float	Specifies the desired error fraction for a reprojection operation. Acceptable values: 0.0-1.0.
`-repronotempfile`		Specifies that GeoExpress should not use temp files for reprojection operations. By default temp files are used.
`-reprores`	float0 float1	Specifies the X and Y resolutions for a reprojected image. You may want to use this switch in conjunction with -alignpixels.

`-reproresample`	string	Sets the resampling method for a reprojection operation.
		Accepted values are:
		    `nearest`: nearest neighbor resampling
		    `bilinear`: bilinear resampling
		    `bicubic`: bicubic resampling
		Default: `nearest`

`-resample`	sint	MG3 and MG4 only. Resamples a file by a power of 2.

SWITCH	VALUE	NOTES
-scale / -s	sint	Specifies the number of zoom levels, or resolution levels, that the encoded image will have. For MG2, this number must be between 3 and 9 inclusive. For MG3, any number greater than zero is supported. For JP2, the acceptable values are 1 through 12.
-sh		See -stripheight / -sh below.
-sharpness	float	MG3 and MG4 only. Increasing this value increases the accuracy of rendering for sharp boundaries between different areas of an image, and reduces ringing at such boundaries. Acceptable values: 0.0-1.0. Default: 0.0.

-statistics / -stats		MG2 only. Collects basic numeric statistics about the image's samples. Data collected includes the minimum, maximum, mean, and standard deviation of the samples for each band. The metadata tags that are added to the output file are:
		`IMAGE::STATISTICS:MAX`
		`IMAGE::STATISTICS:MEAN`
		`IMAGE::STATISTICS:MIN`
		`IMAGE::STATISTICS:STANDARD_DEVIATION`

-stream64		Specifies the use of 64-bit I/O streams.
-stripheight / -sh	sint	MG3, MG4 and JP2 only. Affects memory usage. Increasing this value may improve runtime performance, but at a cost of requiring more physical memory. This value should be decreased when encoding very large images. Changing the strip height does not affect the quality of the output image. Acceptable values: Even integers from 2 to the image's height. Default: 12.
-targetsize / -fs	string	MG3 and MG4 only. Specifies the desired size of the output file in bytes. For example, `-fs 10000` creates a file that is 10000 bytes on disk.
-tempdir	string	Specifies the directory used for storing temp files.
-testencode		Encodes as a test image, which does not decrement the Data Cartridge.
-textFileColumns / -tfc	string	For LiDAR text files, map columns to value types. See LiDAR input switches on page 56.
-textFileOffset / -tfo	int	The number of header rows in the text file. If you do not enter a number, GeoExpress assumes that all rows include valid values.
-textFileQuantization / -tfq	float	Set the quantization scale value.
-thumb	int	Closely related to the `-scale` switch, specifies the target thumbnail size (in pixels), which is the size of the smallest zoom level. For example, `-thumb 32` creates a file with the number of zoom levels that comes closest to a 32 × 32 pixel thumbnail.

SWITCH	VALUE	NOTES
`-tilelengthmarkers / -tlm`	uint	JP2 only. Specifies use of tile length markers and their size. Using tile length markers may improve decoding performance with tiled JPEG 2000 files. Acceptable values: 1-255 Default: 255. Enter 0 to disable.
`-tileparts / -tp`	string	JP2 only. Specifies the organization of tile parts in the codestream. Any combination of the letters R, L, and C is valid. 　N: disable tile parts 　R: group tiles by resolution 　L: group tiles by quality layer 　C: group tiles by component Default: R
`-tilesize / -ts`	sint0 sint1	JP2 only. Specifies the use of tiles in encoding and their size (in pixels). If enabled, the tile size must be no larger than the dimensions of the source image. Smaller tiles reduce the amount of memory required to encode the image, however the use of tiles may introduce edge artifacts. Default: 4096 × 4096. Enter 0 × 0 to disable.
`-tlm`		See -tilelengthmarkers / -tlm above.
`-toepsg`	sint	Specifies the EPSG code describing the output image's desired coordinate reference system. You can also use this switch to specify an output coordinate reference system for mosaics.
`-towkt`	string	Specifies a text file containing a WKT that describes the output image's desired coordinate reference system.
`-tp`		See -tileparts / -tp above.
`-transparencycolor / -tpc`	string	Set values for transparency metadata. For examples and acceptable values, see Setting transparency metadata on page 52
`-ts`		See -tilesize / -ts above.
`-updateinplace`		MG3 only. Performs a tile updating operation in place by appending tiles to the source image.
`-use97wavelet`		JP2 only. Specifies that the floating point 9-7 wavelet be used for encoding, instead of the default integer 5-3 wavelet. The 9-7 wavelet will not encode an image losslessly, however, it may result in a better looking image at higher compression ratios. This option is disabled by default and only available when the `-lossless` option is not specified.
`-uselocallicense`		Specifies the use of a standalone license.
`-usenitflicense`		Specifies preference for a NITF license. If no NITF license is found, GeoExpress will search for another license.
`-usepltmarkers / -plt`		JP2 only. Enables the use of packet length markers. Use of packet length markers may improve decoding performance. By default packet length markers are used.

SWITCH	VALUE	NOTES
`-useserver`	string	Specifies a server where GeoExpress should attempt to find a valid license. If none is found at the specified server, GeoExpress tries other servers.
`-usetempfile`		MG3 and MG4 only. Specifies the use of a temp file to minimize memory usage.
`-version / -v`		Displays version information.
`-watermark`	string	Specifies the name of the watermark image that you want to use. See Watermarks on page 18.
`-weight`	float	MG2 and MG3 only. A higher setting increases the emphasis on the grayscale aspect of a color image, while a lower setting increases the consistency of color between the compressed image and the original data. Acceptable values: 0.0-10.0. Default: 2.0.
`-worldfile / -wf`		Generates a world file.
`-writeboundsshapefile / -wbshp`		Generates a shapefile indicating the boundaries of tiles that make up a mosaic.

mrsidgeoinfo

The mrsidgeoinfo tool displays basic information about an image, such as width, height, file format, and more. Various image formats are supported. For compressed images, GeoExpress also displays the compression ratio of the image and the nominal size.

> **TIP:** For MrSID images, the mrsidgeoinfo tool also displays the generation of the MrSID format used during compression. For example, the tool displays that the image is stored in the MrSID Generation 4 (MG4) format.

By default the mrsidgeoinfo tool is installed in the following directory:

```
C:\Program Files\LizardTech\GeoExpress\bin
```

File Control Switches

SWITCH	VALUE	NOTES
`-inputformat / -if`	string	Identifies the input file format. Accepted values are: `tif`: TIFF 6.0 `bil`: Band interleaved by line (a BBB format) `bip`: Band interleaved by pixel (a BBB format) `bsq`: Band sequential (a BBB format) `doq`: Digital Orthophoto Quadrangle (DOQ) `doq_nc`: DOQ (no clipping) `ras`: Sun Raster `lan`: ERDAS LAN `sid`: MrSID `jpg`: "old-style" JPEG (not JPEG 2000) `jp2`: JPEG 2000 `bmp`: Windows bitmap (BMP) `nitf`: National Imagery Transmission Format 2.0/2.1 (NITF) `img`: ERDAS Imagine
`-mosaic / -mos`		Identifies the input file as an AUX file of mosaic images. Using the `-mosaic` switch creates a flat output file.

Main Switches

SWITCH	VALUE	NOTES
`-metadata / -meta`		Show metadata tags and values.
`-tiles / -tile`		Show tile information (composite MG3 only).
`-genProfile / -prof`	string	Generate JP2 profile.
`-worldFile / -wf`		Generate world file.
`-ignoreWorldFile / -ignorewf`		Ignore georeferencing from world files.
`-tfwOverride / -tifw`		Use `.tfw` file (for TIFF images only).
`-projectDims / -dims`		Show image dimensions at various resolution levels.
`-wkt`		Display any well-known text string (WKT) information for the image.
`-aoi`		Display any Area of Interest (AOI) information for the image.
`-inputFile / -input`	string	Name of input file (required).
`-stats`		Display image statistics for each image band. The image statistics include the minimum value, the maximum value, the mean value, and the standard deviation.

Other Switches

SWITCH	VALUE	NOTES
`-h / -?`		Show short usage message.
`-help`		Show detailed usage message.
`-version / -v`		Show version information.
`-quiet`		Don't show informational message.
`-log`	string	Write output to log file.
`-progress`	string	Progress meter style. Acceptable values: none, `default`, `timer`

Examples

In the following example, the command displays the basic image information for a MrSID image named `image.sid`:

```
mrsidgeoinfo image.sid
```

In the following example, the command line displays the basic image information and the metadata for a TIFF image named `foo.tif`:

```
mrsidgeoinfo -meta foo.tif
```

In the following example, the command line displays metadata information for an AUX file containing JPEG format images named `mosaic.txt`:

```
mrsidgeoinfo -mos -if jpg mosaic.txt
```

Modifications

When the target of a `mrsidgeoinfo` command is a `.sid` file, one element of returned information is the modifications performed on current and past iterations of the image, listed along with MrSID image info.

For example, if you first reproject an image, then crop the results of that operation, then apply a watermark, the final resulting image will indicate `CROPPED REPROJECTED WATERMARKED`.

Modifications that can be listed include:

- ALTERED-COLOR: The actual color values of the pixels were changed from the original. Dynamic range stretching will set this, as will encoding color pixels from a CLUT.
- CHANGED-COLORSPACE: The colorspace was changed (RGB -> grayscale usually, but there are others)
- CHANGED-DATATYPE: The bit depth of the image was changed from the original image. This is typically the result of dynamic range stretching.
- COMPRESSED: The image was compressed lossily
- COMPRESSED-PERBAND: This indicates that per-band compression was used on an MG4 file.
- CROPPED: The image was cropped from the original (the image bounds were reduced)
- EMBEDDED: The image was embedded into a larger area (the image bounds were increased, or padded)
- INTERPRETED-ALPHA: This means that alpha was not present in the original image but was calculated (from transparency, for example); or that alpha was present in the original image but was removed (such as translated to transparency)
- MASKED: A mask was applied to the original image (Area of Interest or crop by vector overlay)
- MOSAICKED: The image is a mosaic of multiple files
- OPAQUE-ALPHA: Alpha was added but it is entirely opaque.
- QUANTIZED: Pixel values were quantized, for example during compression of floating-point datasets
- REORDERED-BANDS: The number and/or order of bands is different from the original image
- REPROJECTED: The image was reprojected from the original image projection
- SCALED: The original image was scaled
- WATERMARKED: A watermark was applied to the image

The modifications are listed in the results alphabetically, not historically; the listing does not give an indication of the order in which the modifications were performed.

mrsidgeodecode

The mrsidgeodecode tool extracts (decodes) all or a portion of a MrSID or JPEG 2000 image to one of several image formats.

By default the mrsidgeodecode tool is installed in the following directory:

```
C:\Program Files\LizardTech\GeoExpress\bin
```

File Control Switches

SWITCH	VALUE	NOTES
-input / -i	string	Input file (required).
-output / -o	string	Output file (required).
-outputFormat / -of	string	Output image format. Acceptable values: tif: TIFF tifg: GeoTIFF jpg: JPEG (not JPEG 2000) bil: (a BBB format) Band interleaved by line bip: (a BBB format) Band interleaved by pixel bsq: (a BBB format) Band sequential bmp: Windows bitmap (BMP)
-inputFormat / -if	string	Input image format

Main Switches

SWITCH	VALUE	NOTES
-watermarkFile	string	Watermark file
-watermarkPosition	string	Position of watermark. Acceptable values: center center_left center_right upper_left upper_center upper_right lower_left lower_center lower_right Default value: lower_right
-dynRangeMin / -drmin	uint	Minimum dynamic range.
-dynRangeMax / -drmax	uint	Maximum dynamic range.
-autoDynRange / -drauto		Automatic dynamic range adjustment.
-worldFile / -wf		Generate world file.
-stripHeight / -sh	uint	Strip height.
-endian	string	Endianness (BBB output only). Acceptable values: little, big
-bsq		Output is .bsq (BBB output only).

MrSID Options

SWITCH	VALUE	NOTES
-password / -pwd	string	Password to decode image.
-bandList / -b	string	A comma-separated list of bands to decode (MG4 only).

JPEG 2000 Options

SWITCH	VALUE	NOTES
-qualityLayers / -layers	uint	Number of quality layers (JPEG 2000 only).

Scene Selection

SWITCH	VALUE	NOTES
`-ulxy`	float0 float1	Upper left of scene (*x*, *y*).
`-lrxy`	float0 float1	Lower right of scene (*x*, *y*).
`-cxy`	float0 float1	Center of scene (*x*, *y*).
`-wh`	float0 float1	Size of scene (width, height).
`-scale / -s`	sint	Scale of scene.
`-coordspace / -coord`	string	Coordinate space of scene. Acceptable values: geo, `image`, `resrel`

Other Switches

SWITCH	VALUE	NOTES
`-h / -?`		Show short usage message.
`-help`		Show detailed usage message.
`-version / -v`		Show version information.
`-quiet`		Don't show informational message.
`-log`	string	Write output to log file.
`-progress`	string	Progress meter style. Acceptable values: none, `default`, `timer`

Examples

To decode a MrSID file to a JPG file:

```
mrsidgeodecode -i input.sid -o output.jpg
```

To decode a MrSID file to a GeoTIFF file:

```
mrsidgeodecode -i input.sid -o geotiff.tif -of tifg
```

To decode the upper-left 50 × 50 pixel scene from a JPEG 2000 image:

```
mrsidgeodecode -i input.jp2 -o output.tif -ulxy 0 0 -wh 50 50
```

To decode an image at scale 2, i.e. one-quarter resolution:

```
mrsidgeodecode -i input.jp2 -o output.tif -s 2
```

Some Definitions

Let us define "input scene" (or just "scene") to be the portion of the MrSID image to be decoded. The scene may be the whole image or some subset. The scene may extend "outside" of the image proper.

Let us also define "output window" (or just "window") to be the region occupied by the image produced by the decoder, e.g. the generated TIFF. Note that the output window may not be the same size as the input scene.

Finally, let us define "coordinate space" to refer to one of three possible ways of specifying regions of the image:

- image space: what we normally think of as "pixel" space, at full resolution
- geo space: the image's geographic space
- resrel space: "resolution relative" space, which is the same as image space but in terms of a given resolution (scale)

Basic Scene Selection

The command line decoder allows you to specify the input scene explicitly in one of three ways:

- upper left (*x*, *y*) corner of scene, and (width, height) of scene

      -ulxy X Y -wh W H

- upper left (*x*, *y*) corner of scene, and lower right (*x*, *y*) corner of scene

      -ulxy X Y -lrxy X Y

- center (*x*, *y*) of scene, and (width, height) of scene

      -cxy X Y -wh W H

For example, consider a 100 × 100 image. To select the upper-left quarter of the image, the following three ways are equivalent:

    -ulxy 0 0 -wh 50 50

    -ulxy 0 0 -lrxy 49 49

    -cxy 25 25 -wh 50 50

(We strongly recommend that you work these examples through manually, to ensure full understanding of the concepts.)

> **NOTE:** If no scene is specified, the decoder defaults to the entire image.

Scaled Scene Selection

Consider again the 100 × 100 image. At scale 1 (half-resolution), this is a 50 × 50 image. To decode the same upper-right quarter at half-res—a 25 × 25 image—these three are equivalent (modulo round-off errors):

    -s 1 -ulxy 0 0 -wh 25 25

    -s 1 -ulxy 0 0 -lrxy 25 25

    -s 1 -cxy 25 25 -wh 25 25

The first form is straightforward: it just says make a scale 1 image, starting at the upper-right corner, of size 25 × 25. The second form is also clear: make a scale 1 image, starting at the upper-right corner and extending down to (25, 25). And the third form is really just a variation of the first: make a scale 1 image, centered at (25, 25), of size 25 × 25...

If our center is at (25, 25) and we're only 25 pixels square, wouldn't our output image run from about (12, 12) to (37, 37)?

Surprisingly, the answer is no, because the image is scaled. The center point is defined in the normal, full-resolution space of the input scene; (25, 25) is correct. But when the image is decoded, that center point is really treated as (12, 12), which is where it is on the scale 1 image. The output window size is expressed in pixels relative to that scaled center point, and so the output image runs from about (0, 0) to (25, 25).

Input Scenes and Output Windows

Recall that in the definitions above, we noted the output window may be different than the input scene. Here's how that can happen.

Consider the following decode on our 100 × 100 image:

    -s 0 -ulxy 0 0 -wh 125 125

This is a normal scale 0 decode, but the output window is 125 × 125— considerably larger than our input scene. The result is an image that really is 125 × 125, with the right and bottom edges left as black (technically, the background color).

One could reasonably argue that allowing the user to specify a decode "outside the image" is a bug, but for an end-user app it's actually a nice feature to have: it lets the user extract out some arbitrarily-sized region of her image, but turn it into a more well-formed size. The classic example of this feature is a decode along these lines:

```
-s 4 -ulxy -wh 32 32
```

which extracts the scaled image into a stock 32 × 32 icon (we assume here that the scale 4 image is of some size less than or equal to 32 × 32, otherwise they'd have to use a smaller scale).

The input scene is always positioned in the upper-left corner of the output window—unless you are using the `-cxy` scene selection mechanism, in which case the input scene is always positioned in the center of the output window.

Geo Coordinate Spaces

The above examples are all done in the familiar "pixel space", where (0, 0) is the upper left corner and the lower right corner is (width-1, height-1) and each pixel is a 1 × 1 object. We call this "image" space and it is the default.

For geo images, however, we often prefer to express points on the image and dimensions in terms of geo coordinates. That is, the upper-left might be (32929.00, 28292.25) and the size of the pixel might be (0.0005, 0.0005).

To accommodate this, we allow the above scene selections to be done in "geo" space. If our 100 × 100 image had an upper-left coordinate of (100.0, 50.0) and an x, y resolution of (10.0, 5.0), we would use the following to decode the whole image:

```
-coord geo -ulxy 100 50 -wh 1000 500
```

That is, the input scene starts at the upper-left position of (100.0, 50.0) and the output window is the full size of the input image (100 × 10 = 1000 and 100 × 5 = 500).

Resrel Coordinate Spaces

We also allow the user to specify the scene using a resolution relative coordinate system ("resrel" for short). In this system, the (x, y) points and the (width, height) dimensions are given in the scale of the decode request instead of the normal scale 0 pixel space.

For example, these are all equivalent ways of taking a small scaled scene from the middle of our 100 × 100 image:

```
-s 1 -ulxy 20 20 -lrxy 39 39 -coord image
-s 1 -ulxy 20 20 -wh 20 20 -coord image
-s 1 -ulxy 10 10 -lrxy 19 19 -coord resrel
-s 1 -ulxy 10 10 -wh 10 10 -coord resrel
```

Note that `resrel` only makes sense for decodes at other than scale 0. When decoding at scale 0, `resrel` is the same as the default image coordinate space.

More Examples

To conclude, the following groups of scene selections using our 100 × 100 image with UL = (100, 50) and res = (10, 5) are all equivalent.

- Full scene, full res (100 × 100 image, all picture at full res):
  ```
  -ulxy 0 0 -wh 100 100 -s 0 -coord image
  -ulxy 0 0 -lrxy 99 99 -s 0 -coord image
  -cxy 50 50 -wh 100 100 -s 0 -coord image
  -ulxy 100 50 -wh 1000 500 -s 0 -coord geo
  -ulxy 100 50 -lrxy 1090 -445 -s 0 -coord geo
  -cxy 600 -200 -wh 1000 500 -s 0 -coord geo
  -ulxy 0 0 -wh 100 100 -s 0 -coord resrel
  -ulxy 0 0 -lrxy 99 99 -s 0 -coord resrel
  -cxy 50 50 -wh 100 100 -s 0 -coord resrel
  ```

- Part scene, full res (50 × 50 image, UL quarter of image at full res):
  ```
  -ulxy 0 0 -wh 50 50 -s 0 -coord image
  -ulxy 0 0 -lrxy 49 49 -s 0 -coord image
  -cxy 25 25 -wh 50 50 -s 0 -coord image
  -ulxy 100 50 -wh 500 250 -s 0 -coord geo
  -ulxy 100 50 -lrxy 590 -195 -s 0 -coord geo
  -cxy 350 -75 -wh 500 250 -s 0 -coord geo
  -ulxy 0 0 -wh 50 50 -s 0 -coord resrel
  -ulxy 0 0 -lrxy 49 49 -s 0 -coord resrel
  -cxy 25 25 -wh 50 50 -s 0 -coord resrel
  ```

- Full scene, half-res (whole image at half res, in UL quadrant of 100 × 100 image):
  ```
  -ulxy 0 0 -wh 100 100 -s 1 -coord image
  -ulxy 0 0 -lrxy 99 99 -s 1 -coord image
  -ulxy 100 50 -wh 1000 500 -s 1 -coord geo
  -ulxy 100 50 -lrxy 1090 -445 -s 1 -coord geo
  -ulxy 0 0 -wh 50 50 -s 1 -coord resrel -ulxy 0 0
  -lrxy 49 49 -s 1 -coord resrel
  ```

- Full scene, half-res (centered) (whole image at half res, in center quadrant of 100 × 100 image):
  ```
  -cxy 50 50 -wh 100 100 -s 1 -coord image
  -cxy 25 25 -wh 50 50 -s 1 -coord resrel
  ```

- Full scene, half-res (centered) (whole image at half res, in center of a 50 × 50 image):
  ```
  -cxy 600 -200 -wh 1000 500 -s 1 -coord geo
  ```

mrsidgeometa

The mrsidgeometa tool is a simple metadata editor.

By default the mrsidgeometa tool is installed in the following directory:

```
C:\Program Files\LizardTech\GeoExpress\bin
```

Switches

SWITCH	VALUE	NOTES
`-file / -f`	string	Name of input file (required).
`-tempDir / -t`	string	Name of temporary directory to use.
`-tpc`	string	Set values for transparency metadata.
`-define / -d`	string	`name=value` string.
`-remove / -r`	string	Remove `tagname` string.
`-rtpc`		Remove transparency metadata.
`-addWL / -awl`	float0 float1	Add window/level metadata.
`-removeWL / -rwl`		Remove window/level metadata.
`-generateDR / -gdr`	string	Calculate dynamic range information from the image statistics and write the dynamic range to the metadata. See possible values below.
`-removeDR / -rdr`		Remove dynamic range metadata.
`-addAffine / -aa`	float0 float1 float2 float3 float4 float5	Add Affine Transformation (world file order).
`-removeAffine / -ra`		Remove Affine Transformation.
`-addWKT / -awkt`	strings	Add well known text string (WKT). See possible values below.
`-removeWKT / -rwkt`		Remove well known text string (WKT).
`-template / -tm`		Template file containing options.
`-worldFile / -wf`		Import world file.
`-jp2_tlm`	unsigned int	Set the maximum number of tile length markers. Acceptable range: 0-255. Specify zero to disable.
`-jp2_plt`		Use packet length markers.
`-jp2_noplt`		Do not use packet length markers.
`-jp2_tilePart`		Set tile parts. Acceptable values: `C│L│R│None`.
`-h / -?`		Show short usage message.
`-help`		Show detailed usage message.
`-version / -v`		Show version information.
`-verbose`		Enable verbose output (diagnostics).

Dynamic range generation methods

When you generate dynamic range metadata, you must enter a dynamic range generation method.

You can enter one of the following methods for generating the dynamic range:

rgb: Calculate the minimum and maximum dynamic range values for an image with red, green, and blue bands. Select the **rgb** method to minimize color shifting for RGB images. When you select the **rgb** method, GeoExpress calculates the combined dynamic range of the red, green, and blue bands.

merge: Calculate the minimum and maximum dynamic range values for an image with multiple bands. Select the **merge** method to preserve the proportions of pixel values across bands. For example, if you want to compare multiple bands in a multispectral image, you may want to select the **merge** method. When you select the **merge** method, GeoExpress calculates the combined dynamic range of all bands.

per-band: Calculate the minimum and maximum dynamic range values for an image with one or more bands. Select the **per-band** method to calculate the dynamic range of each band individually. For example, if you have a multispectral image and you only want to view one band at a time, select the **per-band** method. When you select the **per-band** method, GeoExpress calculates the dynamic range of each band separately.

Automatic and Strict dynamic range

For all images except for 16-bit images with unsigned integer data, GeoExpress uses the exact dynamic range values from the dynamic range generation method that you select. For 16-bit images with unsigned integer data, GeoExpress automatically modifies the calculated dynamic range values to minimize color shifting.

The modified or automatic dynamic range sets the maximum dynamic range value to the estimated bit-depth and sets the minimum dynamic range value to zero.The estimated bit-depth is the next whole number of bits that contains the calculated maximum value in the image. For example, if the maximum value in the image is 3950, GeoExpress estimates that the image was taken with a 12-bit camera and sets the maximum value to 4095. Because GeoExpress sets a wider dynamic range for the image, you can minimize color shifting when you display the image.

For 16-bit images with unsigned integer data, you can force GeoExpress to use the exact dynamic range values calculated by GeoExpress rather than the modified dynamic range values. To use the exact dynamic range values calculated by GeoExpress, append `-strict` to the dynamic range generation method that you select. For example, you might change the dynamic range generation method to `merge-strict`.

Well-Known Text String Types

When you add a well-known text string (WKT), you can specify the WKT in one of three ways.

OGC WKT as a string

You can specify the WKT in OGC standard format:

```
mrsidgeometa -f input.sid -awkt "GEOGCS["WGS 84",DATUM["WGS_1984",SPHEROID
    ["WGS 84",6378137,298.257223563,AUTHORITY["EPSG","7030"]],AUTHORITY
    ["EPSG","6326"]],PRIMEM["Greenwich",0,AUTHORITY["EPSG","8901"]],UNIT
    ["degree",0.01745329251994328,AUTHORITY["EPSG","9122"]],AUTHORITY
    ["EPSG","4326"]]"
```

Note that all the text needs to be entered as one continuous line. Be careful to balance quote marks correctly.

EPSG code

You can also specify the WKT using a standard EPSG code:

```
mrsidgeometa -f input.sid -awkt EPSG:4326
```

Text file

You can pass an OGC WKT in a text file:

```
mrsidgeometa -f input.sid -awkt wkt.txt
```

where `wkt.txt` is a text file containing the WKT string.

Examples

Following are some examples of usage.

The following command adds a `USER::` metadata value to `lena-jp2.jp2`:

```
mrsidgeometa -f lena-jp2.jp2 -d OnePlusOne=Two
```

The following command deletes the tag you just added:

```
mrsidgeometa -f lena-mg3.sid -d OnePlusOne=Two
```

The following command adjusts the dynamic range of the file to a window of 123.456 centered at the level value of 67.89:

```
mrsidgeometa -f lena-jp2.jp2 -awl 123.456 67.89
```

The following command removes the dynamic range adjustment you just made, returning it to the "natural" dynamic range based on the pixel depth:

```
mrsidgeometa -f lena-jp2.jp2 -rwl
```

The following command sets the georeference coordinates of the file to those specified in the world file `lena-jp2.j2w` (in the same directory as the `.jp2` file):

```
mrsidgeometa -f lena-jp2.jp2 -wf
```

The following command removes an existing metadata tag (in this case a non-`USER::` tag).

```
mrsidgeometa -f nokia-jp2.jp2 -r ICC::Profile
```

The following command generates exact minimum and maximum dynamic range values for an RGB image:

```
mrsidgeometa -f 4band.sid -gdr rgb-strict
```

Glossary

A

alpha band

An image band that tracks the portions of an image that you do not want to display. Alpha bands are included in MrSID Generation 4 and are especially useful for aligning images seamlessly.

B

band

A band, or image band, is one set of samples corresponding to one spectral component of an image. For example, a typical image has three bands, a red band, a green band, and a blue band.

BBB

The name of a file format for raw images, short for BIL, BIP, and BSQ.

BIL

A band-interleaved by line image. This format stores all bands of pixel values for each consecutive lline or row of the image.

BIP

A band-interleaved by pixel image. This format stores all bands of pixel values for each consecutive pixel the image.

BSQ

A band sequential image. This format stores all pixel values for each band consecutively.

byte order

The order in which bytes are stored in computer memory. There are two types, little-endian and big-endian. Also known as "endianness".

C

composite mosaic

A MrSID image that contains other MrSID images. Composite mosaics can be created quickly because they do not need to be compressed again, but they may load more slowly than flat mosaics.

compression

The process of transforming information so that it can be stored or conveyed in less space than the original information. See also lossless, lossy and visually lossless.

compression ratio

A ratio of an image's nominal size and an image's compressed size, where the nominal size is calculated from the length, width, number of bands, and number of bits in the image. For example, a raw image compressed from 10 GB to 1 GB has a compression ratio of 10:1.

D

dynamic range

The ratio between the largest and smallest values in an image. Image viewers use dynamic range values to improve the appearance of images. For an image where the dynamic range is less than the full range of possible values for the image, you may want to use your image viewer to stretch the pixel values across the full range.

E

endianness

See byte order.

F

flat mosaic

A MrSID image created from multiple input images. Flat mosaics do not preserve information about each input image and require compressing all the input images again. However, they load more quickly than composite mosaics.

frequency balance

A parameter used in MrSID to determine the emphasis given to edges and flat color areas when performing compression. See also weight and sharpness.

G

gamma

A parameter used in MrSID to determine the emphasis given to edges and flat color areas when performing compression. In MG3 and MG4 encoding, this parameter is called frequency balance. A lower value creates more defined edges, while a higher value creates softer edges.

GML

Geography Markup Language. An open, XML-based specification for representing geographic information including geographic features, coverages, observations, topology, geometry, coordinate reference systems, units of measure, time and other values. Because it is an XML grammar, it is both extensible and adaptable to any application within the broad geospatial field.

K

K-weight

A parameter used in MrSID to determine the emphasis given to the K (black) band of a CMYK image when performing compression.

L

level

See zoom level.

lossless

A compressed image that is identical to the input image across all pixel values. See also lossy and visually lossless.

lossy

A compressed image that approximates the pixel values of the input image. Lossy images are generally significantly smaller than lossless images. Depending on the compression ratio, a lossy image may display compression artifacts or it may appear to the human eye to be identical to the input image. See also lossless and visually lossless.

M

magnification

The scale at which an image is represented. Magnification is expressed as a positive floating point value. For example, 1.0 represents the full image, 0.5 represents a half-scale version, and 2.0 represents a double-scale version. The magnification value must be a power of two. See also scale and zoom level.

metadata

The information stored in an image that is not pixel value information. For example, typical metadata includes image properties like the width, height, and colorspace of the image. Alternatively, some images contain additional metadata such as the name of the image creator, the organization name, the creation date, and more.

MG2

MrSID Generation 2. A previous version of the MrSID image format. MG2 is limited to lossy encoding and does not support optimization nor some of the advanced features available in MG4. See also MrSID and MG4.

MG3

MrSID Generation 3. A previous version of the MrSID image format. MG3 supports lossless encoding, image optimization, composite images, and more. See also MrSID and MG4.

MG4

MrSID Generation 4. The current version of the MrSID image format. MG4 supports all the features of MG3 and adds support for alpha bands and multispectral images.

mosaic

An image created from multiple input images, also called image tiles, to form another larger image. There are two types of mosaics, flat mosaics and composite mosaics.

MrSID

Multiresolution Seamless Image Database - A wavelet-based image format designed for large, high-quality geospatial imagery. The current version of the MrSID file format is MrSID Generation 4. See also MG4.

N

nominal image size

The size of an image calculated from the width, height, number of bands, and number of bits in the image. The nominal size is iindependent of the file format or of the compression used on the image. You can use the nominal size of an image to compare the relative sizes of images in different formats and to calculate the compression ratio for an image. See compression ratio.

O

optimization

The process of creating an MG3 image from a source MG3 image without decoding the image and compressing it again. Common optimization operations include cropping and removal of resolution levels.

P

pixel

A pixel represents a value or set of values for a particular point in a raster image. For images with more than one band, a pixel includes the values of all the bands at the given pixel position.

R

resolution

A measure of the detail in an image. Typically, this is measured in ground units per pixel.

S

scale

The magnification at which an image is represented. Scale is represented as a signed integer, corresponding to the negative of the log of the magnification. That is, magnifications of 1.0, 0.5 and 2.0 are equivalent to scales of 0, 1 and -1 respectively. See also magnification and zoom level.

sharpness

A parameter used in MrSID to determine the sharpness of boundaries between different areas of an image when performing compression. See also frequency balance and weight.

strip height

The number of rows of an image to be processed in each step of an image read operation. Use of smaller strip heights may reduce memory requirements, but at a possible performance loss.

T

transparency color

Also called the no-data value. Pixels that match the transparency color are not displayed. The value can be specificied manually or in the metadata. See also alpha bands.

V

visually lossless

An image that appears to the human eye to be identical to the input image. However, a visually lossless image is actually a lossy image, and as such only approximates the pixel values of the input image.

W

wavelet

A mathematical representation of a pixel value that varies by frequency and duration. In wavelet space, the importance of a pixel depends on the values of its neighboring pixels. Wavelet-based image formats are able to present images at multiple zoom levels without creating image pyramids.

weight

A parameter used in MrSID to determine the emphasis given to the grayscale portion of a color image when performing compression. See also frequency balance and sharpness.

world file

A text file that contains geospatial positioning information to augment or replace the geospatial metadata in an image file.

Z

zoom level

The scale at which an image is represented. Levels are generally expressed with signed integer values. An image at scale 1 has half the width and height of the original. See also scale and magnification.

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