LizardTech

GeoExpress 9.5

User Manual

LizardTech

1008 Western Avenue, Suite 200

Seattle, Washington, USA 98104

206.652.5211

www.lizardtech.com

Preface

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

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Chapter 1: Before You Begin

Product 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.

Here are some of the tasks that you can perform with GeoExpress:

- 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.

Save the images that you create with GeoExpress to a local machine 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.

New Features

Version 9 of GeoExpress includes the following new features and enhancements:

Version 9.5

LiDAR Compression

GeoExpress supports compressing LiDAR point clouds stored in plain-text format or in the LAS and LAZ formats. The output image is stored in the MrSID Generation 4 format or the LAZ format.

Multipolygon Shapefile Cropping

When you crop images, you can define the area that you want to crop with a shapefile. The shapefile that you select can contain multiple polygons. You can then create a single image that contains the area of all the polygons, or you can create separate images for each polygon. Previously, shapefiles needed to contain exactly one polygon.

Batch Color Balancing

Perform color balancing operations on multiple images. When you adjust color balancing settings for one image, you can apply the settings to multiple other images. Previously, you could only color balance single images and mosaics.

Switching Between GeoExpress Editions

Each edition of GeoExpress, including the trial, now uses the same installer. For example, you can enter a license code to change from the trial to the standard edition or from the standard edition to the unlimited version. Previously, you needed to uninstall one edition of GeoExpress then download a separate installer for the other editions of GeoExpress.

Version 9.1

Floating Point Support for MrSID Generation 4

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.

Dynamic Range Metadata Generation

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 12 bits, then you may want to use dynamic range stretching to improve the appearance of the image.

Improved Metadata for Auxiliary Files

When you create an auxiliary file for an image, GeoExpress writes additional metadata into the auxiliary file. If the image contains regions without image data, the no-data values are stored in the auxiliary file. Additionally, if you generate dynamic range metadata for the image, the dynamic range values are stored in the auxiliary file.

Improved Multi-Core Processing

The performance of multi-core processing has been improved. Each job that you run in GeoExpress uses less processing power and finishes faster.

Command Line Image Statistics

You can calculate image statistics for each band in an image from the command line. The image statistics include the minimum value, the maximum value, the mean value, and the standard deviation. Enter the following command to calculate statistics for an image:

```
mrsidgeoinfo -stats <Image Name>
```

Version 9.0

Simple Job List

Any images that you add to the GeoExpress graphical user interface appear in the same simple job list. You can view and run all jobs in the same job list regardless of the image compression

and manipulation operations that you want to perform. Previously, jobs were scattered across multiple tabs.

Intelligent Encoding

GeoExpress automatically uses its optimization feature whenever possible. The optimization feature performs a subset of image compression and manipulation operations without re-encoding images. Previously, to use optimization you needed to remember which operations supported optimization, and you needed to add images to a separate **Optimize** tab.

Graphical User Interface Enhancements

The user interface includes updated window graphics and icons.

Concurrent Processing

If you run GeoExpress on a machine with a multi-core processor or on a machine with multiple processors, GeoExpress creates multiple threads to process jobs more quickly. The number of threads and jobs that you can run at one time depends on the number of cores in your machine's processor.You can use a maximum of eight cores for image encoding.

Image Rotation

For images that include rotation metadata, GeoExpress creates rotated output images. This feature is turned on by default so that your images are displayed with the correct orientation even in viewers that do not support metadata for image rotation. Previously, GeoExpress preserved rotation metadata without rotating the output image.

Custom Watermarks

You can add custom watermarks to your images. GeoExpress supports watermark images in BMP, PNG, and JPEG formats. You can use black and white images with maximum dimensions of 128 pixels by 128 pixels.

Mosaic Enhancements for the Command Line

You can create mosaics that use multiple coordinate reference systems from the command line.

PNG Support

GeoExpress now supports PNG files. You can perform any operation with PNG files that you can perform with other supported file formats.

NITF RPC Support

GeoExpress can now interpret NITF files with RPC metadata.

> *NOTE: To see a list of fixes and other information for the current version of GeoExpress, see the Readme.*

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:

- 2.5 GHz quad core processor
- 4 GB RAM
- 200 MB of disk space for installation and additional space for images
- SATA drive or better

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

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

Operating System Requirements

You can install GeoExpress on 32-bit and 64-bit versions of the following operating systems:

- Windows Server 2012
- Windows 8
- Windows 7
- Windows Server 2008 R2

- Windows Server 2008 Service Pack 2
- Windows Vista Service Pack 2

NOTE: Windows Server 2008 R2 is for 64-bit machines only.

Software Requirements

On Windows, GeoExpress requires the following software to run:

- Microsoft .NET Framework 4.5
- Visual Studio C++ 2010 Redistributable
- SlimDX Runtime .NET 4.0

If this software is not installed on your machine, the GeoExpress installer installs the software for you.

NOTE: The SlimDX Runtime is used to display LiDAR point clouds in 3-D.

Getting the Software

When you purchase GeoExpress, you can choose to download the software from an FTP site or to install from a DVD. The installation software contains a license key, sample imagery, and the GeoExpress documentation.

Alternatively, download the trial of the software from the LizardTech website.

Chapter 2: Installation and Licensing

Installation and Licensing Overview

To set up GeoExpress, complete the following steps:

- Run the GeoExpress installer to install the GeoExpress application and the Express Cartridge Manager.
- Enter a license code or connect to a License Server.
- If you have a copy of GeoExpress Standard Edition, connect to an Express Cartridge Manager Server or use the Express Cartridge Manager to configure a data cartridge.

The GeoExpress Installer

The GeoExpress installer includes the following products:

- **GeoExpress**. The graphical version of GeoExpress. This version includes the command line interface.
- **GeoExpress Command Line**. The command line version only. For more information on the command line version of GeoExpress, see the *GeoExpress Command Line User Manual*.
- **License Server**. A server that hosts floating licenses for networked computers. For more information on floating licenses and instructions for configuring a license server, see *Floating Licenses* on page 219.
- **Express Cartridge Manager**. The data cartridge manager. If you install the Standard Edition of GeoExpress, you must install the Express Cartridge Manager or have access to an Express Cartridge Manager Server.
- **Express Cartridge Manager Server**. A server that hosts a shared data cartridge for networked computers.

- **ExpressView Browser Plug-in**. A browser plug-in that you can use to view MrSID, JPEG 2000, and JPIP files. For browser requirements and usage instructions, see the *ExpressView User Manual*.
- **GeoViewer**. A free geospatial data viewer with support for raster imagery, LiDAR point clouds, shapefiles, WMS sources, and JPIP sources.

NOTE: The products that you see in the installer vary depending on your edition of GeoExpress.

Installing GeoExpress

To upgrade from a previous version of GeoExpress, uninstall the previous version of GeoExpress before you run the installer.

1. Log on to the machine where you want to install GeoExpress with administrator privileges.
2. Navigate to the directory where you downloaded the installer or insert a GeoExpress installation DVD into your DVD drive.

   If you downloaded the installer from an FTP site, the installer is saved as an ISO file. To open the ISO file, perform one of the following steps:

   - Burn the ISO file to a DVD.
   - Use an ISO reader to mount the file to a virtual drive.
3. Run the `AutoRun.exe` program.

   The **Product Selection** window opens.
4. Click **GeoExpress**.

   The **GeoExpress Installation Wizard** opens in a separate window.
5. The installation wizard prompts you to complete the following tasks:
   - Accept the License Agreement.
   - Select the directory where you want to install GeoExpress.
   - Install the Microsoft .NET Framework and Visual Studio C++ Redistributable.
   - Optionally, add GeoExpress to your machine's path environment variable. If you add GeoExpress to your machine's path, you can run GeoExpress commands from the command line without navigating to the GeoExpress directory.

6. In the **Product Selection** window, click any other products that you want to install and follow the installation instructions.
7. Close the **Product Selection** window.

Licensing GeoExpress

The first time that you run GeoExpress, you must enter a serial number and license code. Alternatively, instead of entering a license code, you can connect to a license server.

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. If you want to use GeoExpress as a trial for 30 days, you do not need to enter a serial number.

License codes are specific to your machine. You can enter the temporary license code included with the software to use GeoExpress for 30 days, or 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.

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

NOTE: You must run GeoExpress with administrative privileges to activate a license code or switch to a permanent license code.

Requesting a License

1. Run GeoExpress by clicking the desktop icon or by clicking the **Start** menu and clicking **Programs > LizardTech > GeoExpress > GeoExpress 9**.

   GeoExpress starts.

2. Click **Options > Licensing**.

   The **License Management** dialog box appears. If the temporary license code has expired, the **License Management** dialog box opens when GeoExpress starts.

3. In the **Request License** section, click **Copy**.
4. Click the **Request License** button to open a web browser and navigate to the following

URL:

https://www.lizardtech.com/support/product-activation/

5. Fill out the form and paste your locking code in the **Locking Code** field.

   LizardTech Customer Support will send you a license code within one business day.

NOTE: If you use GeoExpress with a license server, you do not need to get your machine's locking code.

Entering a Serial Number and License Code

1. Run GeoExpress as an administrator by right-clicking on the desktop icon and selecting **Run as administrator**.
2. Click **Options > Licensing**.
3. In the **Enter License** section, enter the serial number that you received from LizardTech Customer Support.

   The **View License** section displays whether the serial number is valid.
4. In the **Enter License** section, enter the license that you received from LizardTech Customer Support.
5. Optionally, if you purchased a NITF license, select the **Prefer NITF License** check box
6. Click **OK**.

   The main window title displays the license type.

Connecting to a License Server

1. Run GeoExpress as an administrator by right-clicking on the desktop icon and selecting **Run as administrator**.
2. In the **Enter License** section, enter the name of the License Server. For example, you might enter the following server name:

   `LIZARDTECH-SERVER`
3. Click **OK**.

For more information on floating licenses and the LizardTech License Server, see *Floating Licenses* on page 219.

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. Data cartridges are generated by LizardTech and emailed to you as an attached file. You manage data cartridges in the Express Cartridge Manager. You can either install a data cartridge on your local machine or you can use a data cartridge from an Express Cartridge Manager Server.

For more information on configuring the Express Cartridge Manager and how to calculate data usage, see *Data Cartridges* on page 217.

Requesting a Data Cartridge

1. Click **Start > Programs > LizardTech > Express Cartridge Manager ID**.

   The **Express Cartridge Manager** window opens.

2. Copy the Express Cartridge Manager ID.

3. Open a web browser and navigate to the following URL:

   https://www.lizardtech.com/support/product-activation/

4. Fill out the form and paste your ID into the **Express Cartridge Manager ID** field.

   LizardTech Customer Support will send you a data cartridge within one business day.

Installing a Data Cartridge

1. Save the email attachment that you received from LizardTech Customer Support on your local drive.

2. Run GeoExpress by clicking the desktop icon or by clicking the **Start** menu and clicking **Programs > LizardTech > GeoExpress > GeoExpress 9**.

   GeoExpress starts.

3. Click **Tools > Data Cartridge**.

4. Click the **Administration** tab.
5. Click **Install New Local Data Cartridge**.
6. Navigate to the directory where you saved the email attachment.
7. Select the email attachment and click **Open**.

   The data cartridge installs.

Connecting to an Express Cartridge Manager Server

1. Run GeoExpress by clicking the desktop icon or by clicking the **Start** menu and clicking **Programs > LizardTech > GeoExpress > GeoExpress 9**.

   GeoExpress starts.

2. Click **Tools > Data Cartridge**.
3. Select the **Use Network ECM** option.
4. Click **Select a Network ECM** and enter the host name and port number of the Express Cartridge Manager Server.

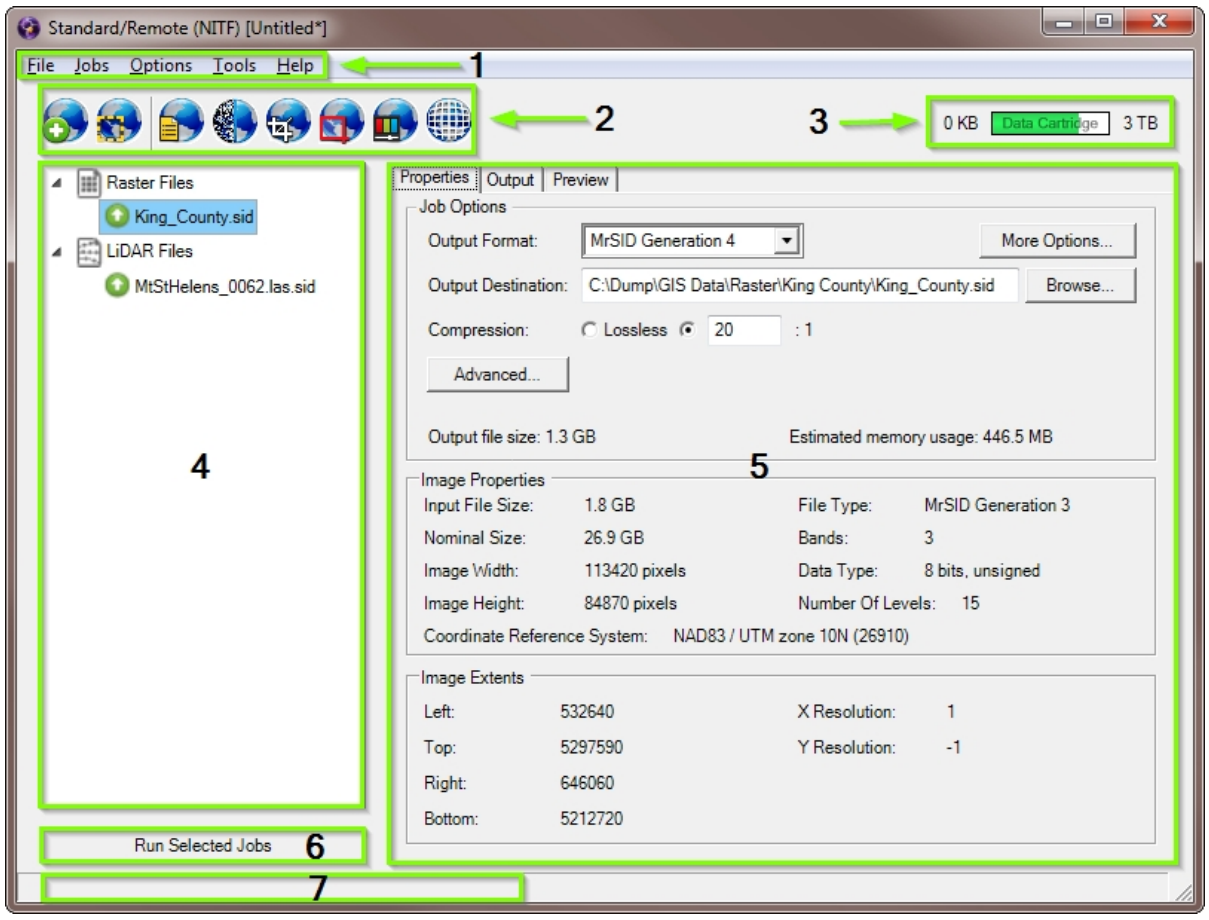
   By default, the port number is 9002.

Chapter 3: Graphical User Interface

Graphical User Interface Overview

You can use the GeoExpress graphical user interface to complete all compression and manipulation tasks. To access the graphical user interface, click the desktop icon. Alternatively, click the **Start** menu and click **Programs > LizardTech > GeoExpress > GeoExpress 9.5**.

The following figure shows the GeoExpress graphical user interface:



1. Menu Bar
2. Toolbar
3. Data Cartridge Gauge
4. Job List
5. Properties, Output, and Preview Tabs
6. Run Button
7. Status Bar

Menu Bar

The menu bar is a central place where you can view most of the tasks that you can perform in GeoExpress and the options that you can set.

The following table describes some of the options unique to the menu bar:

Option	Description
File > Save project	Save the jobs that you have open in a project file. Project files store the options that you have set for each job.
Options > Preferences	Edit preferences for raster images. You can edit the default output directory and file format, set a default compression ratio for each file format, and more.
Options > LiDAR Preferences	Edit preferences for LiDAR images. You can edit the default compression ratio, the default number of points to display in the preview of point clouds, and more.
Options > Licensing	View your locking code, add a license, or select a license server.
Tools > Data cartridge	Install a data cartridge, select an Express Cartridge Manager Server, or view the Express Cartridge Manager history.

For a full description of all menu options, see *Appendix C - Summary of Menu Options* on page 229.

Preferences Dialog Box

The **Preferences** dialog box can be used to set default job options and other global settings for raster files. In this dialog box you can set general preferences, default parameters for MrSID and JPEG 2000 encoding, and color and line appearance in editors and selectors.

For more information about the options available on each tab, see *Raster Preferences* on page 160.

LiDAR Preferences Dialog Box

The **LiDAR Preferences** dialog box can be used to set the default preferences for LiDAR data, including compression options, text parsing options, and preview options.

For more information about the options available, see *LiDAR Preferences* on page 173.

Toolbar

Access the GeoExpress toolbar to add images and mosaics to the **Job List** and to perform image manipulation tasks. The tools that you can access in the toolbar vary depending on the image that you select in the **Job List**.

The toolbar contains the following tools:

Tool Icon	Tool Name	Description
	Add Image	Add an image to the **Job List**. You can add multiple images at a time.
	Create New Mosaic	Create an image mosaic from a set of georeferenced images. A mosaic is a set of images that has been joined together to form a single image. When you create a mosaic in the MrSID file format, you can create either a flat or composite mosaic.
	Edit Metadata	Edit the metadata of an image. For raster and LiDAR files, you can change the projection information stored in the metadata. For raster images, you can also include custom information in the image. For example, you can add your company name to the image.
	Despeckle	Remove speckling from MrSID and JPEG 2000 images. Raster images only.
	Image Crop	Crop an image. Raster images only.
	Area of Interest	Specify part of an image as an area of interest. You can change the compression ratio of the area of interest to preserve more image detail in that part of the image or to blur that part of the image. Raster images only.
	Color Balance	Edit the brightness, contrast, and gamma values for an image. You can also change the values for each band in an image. Raster images only.
	Reproject	Change the projection used by the image. You can specify a custom well known text (WKT) string or select a standard coordinate reference system. Raster images only.

Data Cartridge Gauge

The data cartridge gauge is a small graphic display in the upper right corner of the main screen that indicates the percent of the data cartridge remaining. Hold the mouse pointer over the data

cartridge gauge to display the exact amount of data remaining in the data cartridge.

For information on how usage is calculated, see *Data Cartridges* on page 217. For information on activating cartridges, see *Licensing GeoExpress* on page 9. For general information about data cartridges, see *Frequently Asked Questions* on page 226.

To order additional cartridges, contact your LizardTech sales representative.

> *NOTE: GeoExpress Unlimited Edition has no data cartridge.*

Job List

The **Job List** is the pane on the left side of the GeoExpress user interface that displays the raster and LiDAR files with which you want to work. The **Job List** enables you to add or remove images for compression and manipulation operations, work with project files, select images to view information about them, and run your jobs.

The job list is divided into a section for raster files and a section for LiDAR files. GeoExpress treats each image, point cloud, and mosaic in the **Job List** as a discrete job. The name displayed in the **Job List** is a user-specified job name that has no effect on the resulting output file.

To add images and point clouds to the **Job List**, click the **Add Image** button in the toolbar. Alternatively, drag images into the job list from another application. To create a mosaic, click the **Create New Mosaic** button. The **Job List** displays the tiles that you add to a mosaic in an indented list.

Select an image in the **Job List** to view information about the image in the **Properties**, **Output**, and **Preview** tabs.

Context Menu

When you right-click on one or more jobs that you have selected in the **Job List**, the context menu appears. The context menu, or the right-click menu, displays the following options:

Option	Description
Edit > Cut	Remove the selected job from the **Job List**. Use the **Cut** option with the **Paste** option when you want to move an image or tile to another position in the **Job List**.
Edit > Copy	Create a copy of the selected image or tile. Use the **Paste** option to specify where you want to place

Option	Description
	the copy.
Edit > Select All	Select all the items in the **Job List**.
Run	Run one or more selected jobs.
Cancel	Stop one or more running jobs.
Remove	Remove one or more jobs that you have selected from the **Job List**.
Job Options	Set options for the input file, output file, bands and compression, zoom levels, and alpha bands.
Metadata Options	Edit the image metadata.
Tile Options	Manage tiles. You can add tiles, remove tiles, crop tiles, change the order of the tiles, and set a coordinate reference system for tiles.
NITF Image Segments	Select the image segments that you want to include in the output file.
Export Job Settings	Export information about the selected job and about the version of GeoExpress that you are using. The job settings are saved in a text file. Export job settings when you want to remember the options that you selected for a particular job or when you want to contact LizardTech Customer Support.

Properties Tab

The **Properties** tab displays information about the selected job. The contents of the panels on the **Properties** tab depend on whether the selected job is a raster job or a LiDAR job. The contents also change if you select multiple jobs, if you select a mosaic, and more.

The Job Options Panel

Use the **Job Options** panel to specify an output file format, destination, and compression ratio. The **More Options** button displays additional options. You can set options for multiple selected jobs, in which case options that do not apply to the entire selection are not available. For raster jobs, the panel also displays the output file size and estimated memory usage.

*NOTE: For raster jobs, the estimated memory usage only displays when you select MG2, MG3, and MG4 as the **Output Format**. For more information on how the memory usage is calculated, see Calculating Memory Usage on page 195.*

The Image Properties Panel

The **Image Properties** panel, or the **Mosaic Properties** panel if you select a mosaic, displays information about the input file or files selected in the job list. If you select multiple files, the panel displays the information that the files have in common.

The **Image Properties** panel displays the following information for raster files:

- Input File Size. The size of the selected image file. If the file contains header information, the file size can be more than the nominal size.
- Nominal Size. The calculated size of the image based on the image size and resolution. The nominal size measures the size of the image independent of whether the image is compressed.
- Image Width. The image width.
- Image Height. The image height.
- Coordinate Reference System. The coordinate reference system of the image.
- File Type. The file type of the image.
- Bands. The number of bands in the image. Rest the mouse pointer over the number of bands to see the color space of the image.
- Data type. The image data type. For example, 8 bits, unsigned.

The **Image Properties** panel displays the following information for LiDAR files:

- File Name. The name of the file.
- X. The range of X values in the point cloud.
- Y. The range of Y values in the point cloud.
- Z. The range of Z values in the point cloud.
- File Type. The file type of the image.
- Points. The number of points in the point cloud.
- Input File Size. The size of the selected point cloud file. If the file contains header information, the file size can be more than the nominal size.

- Nominal Size. The calculated size of the file based on the number of points and the number of fields for each point. The nominal size measures the size of the point cloud file independent of whether the file is compressed.

The **Mosaic Properties** panel displays the following information for raster files:

- Mosaic Width. The total width of the mosaic.
- Mosaic Height. The total height of the mosaic.
- Mosaic Image Size. The calculated size of the mosaic.
- Coordinate Reference System. The coordinate reference system of the mosaic.
- File Type. The file type of the image.
- Bands. The number of bands in the mosaic. Rest the mouse pointer over the number of bands to see the color space of the mosaic.
- Data type. The image data type. For example, 8 bits, unsigned.

For LiDAR files, the **Mosaic Properties** panel displays the same information as the **Image Properties** panel above except for all the files in the mosaic. To view information about a single file in the mosaic, select the file in the job list to display the **Tile Properties** panel.

The Extents Panels

For raster images, the **Extents** panel indicates where the image resides in geographic space and the pixel resolution of the image.

For raster mosaics, the **Extents** panel includes mosaic extents and tile extents. Mosaic extents indicate the boundaries and resolution of the entire selected mosaic, while tile extents indicate the extents of a single mosaic tile.

Job Options Dialog Box

When you click **More Options** in the **Properties** tab, the **Job Options** dialog box appears. The **Job Options** dialog box displays the most common options for a job. The contents of the **Job Options** dialog box vary depending on whether the selected job is a raster job or LiDAR job.

For raster jobs, the **Job Options** dialog box displays the following tabs:

- Destination
- Format and Compression

- Dimensions and Resolution
- Tiling

For LiDAR jobs where you select MrSID Generation 4 (MG4) as the output format, the **Job Options** dialog box displays the following tabs:

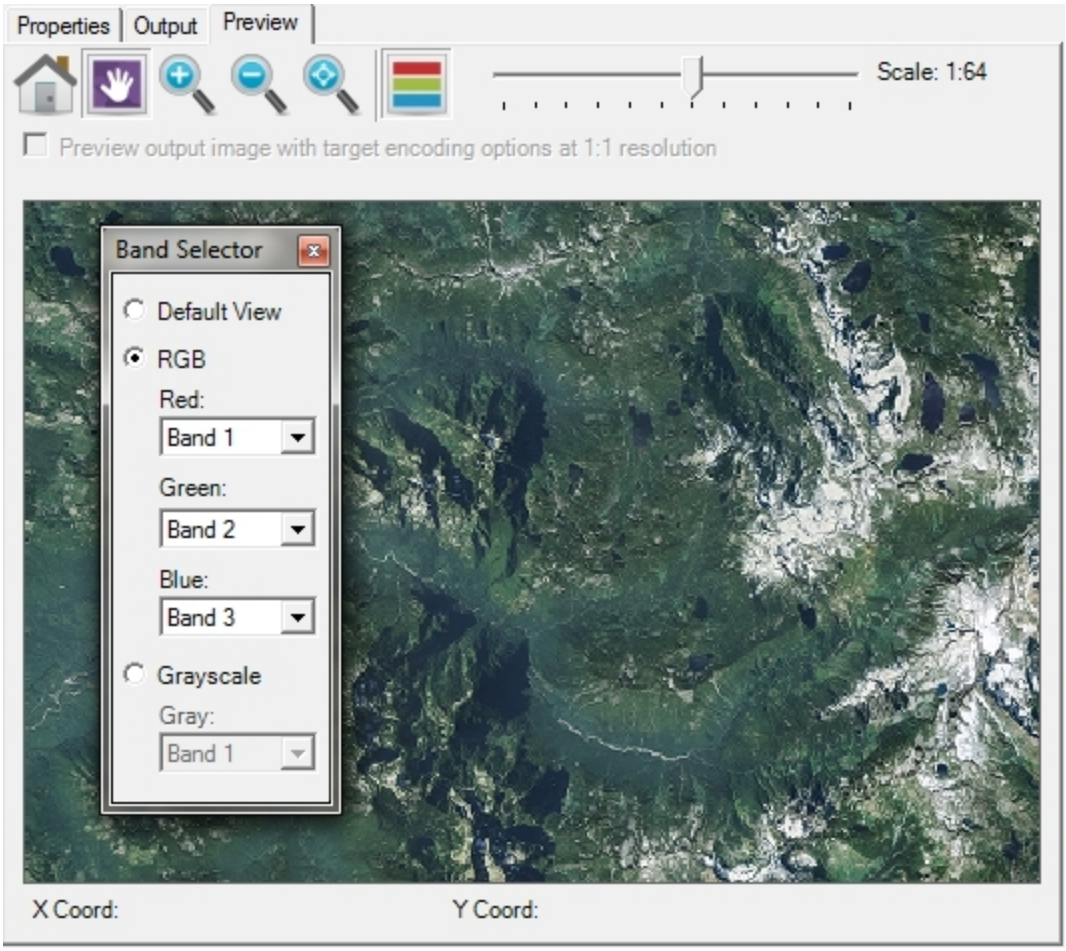
- Compression
- Text Parsing

> *NOTE: If you select an output format other than MG4, the **More Options** button is unavailable.*

Preview Tab

You can preview raster images and LiDAR point clouds. For raster images, you can preview images to see the expected output of a compression or manipulation operation. To cancel the rendering of a preview image, click on the **Properties** or **Output** tab.

The following figure shows the **Preview** tab:



X and Y coordinates for the position of the cursor are given below the image pane.

For more information on how to preview an image or mosaic, see *Previewing an Image* on page 34 and *Previewing a Mosaic* on page 153.

Previewing Raster Images

The **Preview** tab includes a toolbar that you can use to navigate the preview image. For raster images, you can move the slider in the toolbar to change the scale of the preview image. If you set the scale to 1:1, you can click the check box labeled **Preview output image with target encoding options at 1:1**. When you select the check box, GeoExpress runs the image compression or manipulation operations on the visible portion of the image.

For multispectral imagery, click the **Band selector** button  in the toolbar of the **Preview** tab to manually select the bands that you want to preview. You can select **Default View**, **RGB**, or **Grayscale**. The **Default View** uses the first three bands of the multispectral image as the RGB

bands. To manually select the RGB bands that you want to use, select the **RGB** option. Click **Grayscale** to view a single band of the source image as a grayscale image.

> *NOTE: The **Band Selector** only affects the image preview. To change the RGB bands used in the encoding process, click **Advanced** in the **Properties** tab. Then, select the RGB bands that you want to use in the **Bands** tab.*

Previewing LiDAR Point Clouds

LiDAR point clouds are displayed in 3-D. Click the **Orbit focal point** button  to rotate the image. Click the **Refresh points** button  to clear the preview pane and render the points in the current view again. To render your points quickly, GeoExpress draws a representative sample of your points rather than drawing every single point. If you pan or zoom in, you may want to refresh points to draw more points in the area that you are viewing. To increase or decrease the default number of points that GeoExpress draws, see *Viewing Preferences* on page 176.

If the color gradient for the LiDAR point cloud does not display properly, you may also want to adjust the gradient range for the point cloud. Click the **Previewer settings** button  to adjust the gradient range. For example, if the point cloud displays as a single color rather than a gradient range of multiple colors, it's likely that one or more points in the point cloud has an incorrect Z value. In this case, you may want to adjust the minimum or maximum Z value used for the gradient.

> *NOTE: To preview a LiDAR point cloud stored as a text file, ensure that you select the option to **Read the whole file** when the **Text Parsing** dialog appears.*

Output Tab

The **Output** tab shows the session log and the progress of running jobs. Use the **Output** tab to monitor the progress of running jobs, cancel running jobs, and export the session log.

For more information about log files and for a sample log file entry, see *Viewing and Using Log Information* on page 177.

Run Button

Click the **Run** button to run one or more jobs. The jobs that you run depend on which jobs you have selected in the **Job List**. If no jobs are selected, then the **Run** button runs all jobs.

For more information on running jobs, see *Running Jobs* on page 35.

Status Bar

The status bar in the lower-left corner displays a message when GeoExpress renders an image preview. Use the status bar to check that your image preview is being generated.

Chapter 4: Getting Started

Getting Started Overview

This chapter describes the process for most compression and manipulation operations in GeoExpress.

To perform compression and manipulation operations, complete the following tasks:

1. Add images, LiDAR point clouds, or mosaics to the **Job List**. The images, point clouds, and mosaics that you want to compress or manipulate in GeoExpress are called jobs.
2. Select the jobs that you want to manipulate or compress.
3. Select an output format.
4. Select an output destination.
5. Specify how much you want to compress the job.
6. Optionally, for images and mosaics, perform image manipulation operations. For example, you might despeckle or reproject an image.
7. Optionally, set job options to specify additional options. For example, for raster images, you might change the resolution or create image tiles.
8. Optionally, preview the image or point cloud before running the job.

9. Optionally, for raster images, create a test image.
10. Run the job.

Adding Jobs to the Job List

Before you can compress or manipulate images and point clouds, you must add them to the **Job List**. When you add a raster or LiDAR mosaic to the **Job List**, you can show or hide the tiles that make up the mosaic. To show or hide the tiles in a mosaic, click the arrow next to the name of a mosaic.

1. Click the **Add Image** button  or the **Create New Mosaic** button  in the toolbar.
2. Browse files and select one or more images or point clouds that you want to add to the **Job List**. To select multiple images, hold down the **CTRL** key and click on each image or point cloud that you want to add.
3. Click **Open**.

*NOTE: If you add a LiDAR text file to the **Job List** you must set text parsing options so that GeoExpress can match the columns in the text file to standard fields. For more information, see LiDAR Text Parsing Options on page 95.*

*TIP: You can also drag images and point clouds into the **Job List** from your system's file manager. Alternatively, click **File > Add image(s)**.*
*To add an image that you opened recently, click **File > Recent files**.*

Supported Input Formats

The following 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
CADRG	Varies. Most common file extension is .toc.	8-bit unsigned	No	
DTED	.dt0, .dt1,	16-bit signed,	No, limited to	

File Format	File Extension	Supported Data Types	Supports Multispectral	Notes
	.dt2	32-bit floating point	one band	
ECW	.ecw	8-bit unsigned	Yes	Earth Resource 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, the 2nd, 3rd, and 4th bands are interpreted as red, green, and blue, respectively.
JPEG	.jpg, .jpeg	8-bit unsigned	No, limited to three bands	Requires a world file for georeferencing.
JPEG 2000	.jp2, .jpc	8-bit and 16-bit signed and unsigned	Yes	Multiple bands supported for all color spaces.
LAS	.las		N/A	This is a binary, uncompressed LiDAR point cloud format. GeoExpress supports LAS versions 1.0 through 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 Generation 3 (MG3)	.sid	8-bit and 16-bit unsigned	No	4 bands are supported for CMYK input only.
MrSID Generation 4 (MG4) LiDAR	.sid		N/A	This is a binary, uncompressed LiDAR point cloud format.
MrSID Generation 4 (MG4) Raster	.sid	8-bit and 16-bit signed and	Yes, up to 255 bands	Multiple bands supported for all color spaces.

File Format	File Extension	Supported Data Types	Supports Multispectral	Notes
		unsigned, 32-bit floating point		
NITF 2.0, 2.1.	.ntf	8- and 16-bit signed and unsigned	Yes	Only supports uncompressed, JPEG compressed, and JP2 compressed data.
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	Varies. Most common file 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 206.
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 for Windows platforms.

Input Format Notes

- Password-protected MrSID files cannot be used as input files.
- While GeoExpress encodes indexed color images, it is strongly recommended that you scan data into 8-bit grayscale or 24-bit color before encoding. In this case, 24-bit color refers to the number of bits for a pixel value in a three-band image.

- World files are supported for all image formats.
- The LAS, LAZ, MG4 LiDAR, and Text file formats are for LiDAR point clouds only.
- GeoExpress does not support LiDAR waveform data.
- GeoExpress has experimental support for LAS 1.4 files. For LAS 1.4 files, extended variable length records (EVLR) and well known text (WKT) definitions are known not to be supported.

When you compress floating point images, GeoExpress uses the quantization compression method. For more information on floating point images, see *Using Quantization for Floating Point* on page 43.

> *IMPORTANT: An option is available to allow world files to override native georeferencing. Note that this will override any coordinate reference system (CRS) metadata – including well-known text strings (WKTs) – that may have been embedded in the file. In this situation you can manually edit the image's CRS on the Reprojection Manager accessible by choosing Reproject from the Tools menu. For more information, see World Files on page 182.*

Removing Jobs from the Job List

To remove a job from the **Job List**, right-click on the job name and click **Remove**. Alternatively, select the job that you want to remove and press the **Delete** key.

When you remove a mosaic job from the **Job List**, you also remove all the tiles associated with the mosaic.

> *NOTE: You do not need to remove an image or mosaic from the **Job List** to keep it from being encoded. Only the files that you select in the **Job List** are encoded when the **Run** button is clicked.*

Selecting Jobs

Select a job in the **Job List** to view information about the job, set job options, and run the job.

To select a job, click on the name of the job. To select multiple jobs, hold the **CTRL** key while you click on the names of the jobs that you want to select. To select multiple consecutive jobs, hold the **SHIFT** key and click on the names of the first and last images that you want to select. For

example, you have six jobs in the **Job List** and you want to select the second, third, and fourth jobs. Hold the **SHIFT** key, then click on the second job and the fourth job. The three jobs are selected.

To select all the jobs in the **Job List**, right-click anywhere in the **Job List** and click **Edit > Select All**. Alternatively, use the **CTRL+A** keyboard shortcut.

Selecting an Output Format

When you compress an image or point cloud, the default output format is MrSID Generation 4. You can change the output format in the **Properties** tab.

1. Select one or more jobs in the **Job List**.
2. Click **Properties** to view the **Properties** tab.
3. In the **Job Options** panel, select an output format from the **Output Format** drop-down.

NOTE: Some output formats may not be available depending on certain properties of your input image, such as the data type and number of bands.

Supported Output 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

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 *Comparison of Compressed Output Formats* on page 39.

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 1.3 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.

Selecting an Output Destination

Select an output destination to specify where you want to save the output file. By default, the output destination is the same directory where the input image is stored.

For more information about the output destination, and to select an Express Server as the output destination, see *Destination Options* on page 91.

Specifying a Compression Method

The images and point clouds that you create with GeoExpress are compressed by default. To specify how much you want to compress each raster image, you can specify a compression ratio, specify a target file size, use lossless compression, set per-band compression ratios, or use quantization. For LiDAR point clouds, you can specify a compression ratio or select lossless compression.

Use lossless compression for an image or point cloud to compress the data as much as possible without changing the image or point cloud. To use lossless compression, click the **Properties** tab and select the **Lossless** radio button.

Specify a compression ratio for an image or point cloud to specify how much smaller you want the output to be than the input. For example, if you have an uncompressed 100 megabyte image and you specify a compression ratio of 20:1, the file size of the output image is 5 megabytes. To set a compression ratio for a selected image, click the **Properties** tab and select the radio button next to the blank compression ratio field. Then, enter the compression ratio that you want to use.

When you compress floating point images, GeoExpress uses the quantization compression method. For more information, see *Using Quantization for Floating Point* on page 43.

For more information on compression, see *Compression* on page 39. For more information on setting default compression preferences, see *Preferences* on page 159.

Performing Image Manipulation Operations

For raster images and mosaics, you can use the tools in the **Toolbar** to perform the following image manipulation operations:

- Edit metadata for an image.
- Despeckle an image.
- Crop an image.
- Select an area of interest.
- Set color balancing for an image.
- Reproject an image.

> *NOTE: You can also edit the coordinate reference system metadata of LiDAR point clouds.*

For more information on each image manipulation operation, see *Image Manipulation* on page 45.

Setting Job Options

To set job options, click **More Options** in the **Properties** tab. The job options that you see depend on whether the job is for a raster file or a LiDAR file and on the output format that you

select.

For raster images, you can use job options to select tiling options, enter a custom resolution or set of dimensions, and more. For LiDAR point clouds, you can use job options to remove LAS variable length record (VLR) metadata, set column mapping options for text files, and more.

For more information, see *Job Options Overview* on page 91.

*NOTE: For raster images, you can also click **Advanced** to set additional options. For example, you can use the advanced options to select a color space, edit transparency values, and more. For more information on advanced job options, see Advanced Job Options on page 97.*

Previewing an Image

You can preview raster images and LiDAR point clouds.Preview images to see the expected output of a compression or manipulation operation. When you preview an image, you do not use data from the data cartridge.

1. Select the job in the **Job List**.
2. Click the **Preview** tab.

   The preview renders in the **Preview** tab.

3. Optionally, for raster images, move the slider above the preview image to change the scale of the image or click the **Band Selector** button  to manually select the bands that you want to view.

For more information on the **Preview** tab and the **Band Selector**, see *Preview Tab* on page 21.

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 images and mosaics as test images, but not LiDAR point clouds.

1. Select one or more jobs in the **Job List**.
2. Click **Advanced** in the **Properties** tab.

The **Advanced Job Options** dialog box appears.

3. Click the **Output** tab.
4. Select the **Encode As Test Image** check box and click **OK**.
5. Click the **Run** button to run the job.

The following figure shows a test image:

Running Jobs

When you run a job, GeoExpress performs the compression and manipulation operations that you selected. To run one or more jobs, select the jobs that you want to run and click the **Run Selected Jobs** button. To run all jobs, click a blank space in the **Job List** to ensure that no jobs are selected and click the **Run All Jobs** button.

When you run one or more jobs, GeoExpress displays the **Output** tab. Use the **Output** tab to monitor the progress of the operation. To cancel one or more running jobs, click the **Cancel job** button or the **Cancel all** button in the **Output** tab.

If you click away from the **Output** tab, GeoExpress continues running the jobs in the background.

TIP: GeoExpress adds information about each job that you run to the GeoExpress log file. For more information on logs, see Viewing and Using Log Information on page 177.

Exporting Job Settings

Export job settings when you want to save information about a particular job. The job settings are saved to a text file and include the following information:

- GeoExpress version number.
- Job properties from the **Properties** tab.
- Job options.

To export job settings, right-click on the name of a job in the **Job List** and click **Export Job Settings**.

Working with Project Files

To save the state of the **Job List**, create a project file. The project file is a text file that saves each job in the **Job List** and any options that you have applied to each job.

The project file saves the file path of each image, mosaic tile, and LiDAR point cloud in the **Job List**. If you move an files to another directory, you can edit the project file in a text editor.

Opening a Project

To open an existing project, click **File > Open project** in the menu bar. Saving an edited project overwrites the original.

*NOTE: In GeoExpress version 8.5 and earlier, the **Job List** contained multiple tabs. If you open a project file that was created in any of these versions, GeoExpress 9 displays all the jobs together in the simplified **Job List**.*

Creating a New Project

To create a new project, click **File > New project** in the menu bar. When you create the new project, you clear the **Job List**. If there are items in the **Job List** that have not been saved, GeoExpress prompts you to save the jobs in a project file.

Saving a Project

To save a project, click **File > Save project**.

Chapter 5: Compression

Compression Overview

Compress your images and point clouds to decrease the size of the files. GeoExpress compresses your images and point clouds by default.

When you compress raster images with GeoExpress, you can specify a compression ratio, specify a target file size, use lossless compression, or use quantization for floating point images. If you decide to specify a compression ratio for a raster image, you can specify a separate compression ratio for each band in an image. When you compress LiDAR point clouds with GeoExpress, you can specify a compression ratio or use lossless compression.

If you specify a compression ratio or a target file size, GeoExpress uses lossy compression. When you use lossy compression, you compress an image to a much smaller file size by discarding some image data or removing points from a point cloud. Additionally, when you compress a floating point image, GeoExpress uses a lossy compression method called quantization to compress the image.

When you use lossless compression, you compress an image as much as possible without discarding any image data.

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: Select an image in the job list to view the file format, output file size, and more in the **Properties** tab.*

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 maximum of 3 bands, cropping but no advanced encoding, output less than 2 GB	♦	♦	♦	♦
Advanced encoding (reprojection, color balancing, despeckling, area of interest encoding, etc.)		♦	♦	♦
Output file size greater than 2 GB		♦	♦	♦
Lossless output		♦	♦	♦
Mosaic that has MrSID tiles 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	MG4
Lossless compression	♦	♦
Specifying a compression ratio		♦
Creating mosaics		♦

For more information on output formats, see *Supported Output Formats* on page 30.

Specifying a Compression Ratio

Specify a compression ratio for an image to specify how much smaller you want an image to be than the input image. For example, if you have a 100 megabyte image and you specify a compression ratio of 20:1, the file size of the output image is 5 megabytes.

1. Click the **Add Image** icon to add an image to the **Job List**.
2. Select the image in the **Job List**.
3. In the **Properties** tab, select the radio button next to the blank compression ratio field. Then, enter the compression ratio that you want to use.
4. Enter the ratio that you want to use in the text field.

As a rule of thumb, you can compress raster images to a ratio of 20:1 without introducing noticeable compression artifacts. Compression artifacts include blurring and speckling. By default, the compression ratio for RGB images is 20:1 and the compression ratio for grayscale images is 10:1. For multispectral images and LiDAR point clouds, GeoExpress uses lossless compression by default.

Specifying Per-Band Compression Ratios

You can set individual compression ratios for each band in a multispectral image. Use per-band compression when you want to compress certain bands in an image more than others. For example, if you want to preserve the visual quality of a multispectral image, you can compress the RGB bands of the image less than the other bands. You can only set per-band compression ratios for MrSID Generation 4 output images.

1. Click the **Add Image** icon to add an image to the **Job List**.
2. Select the image in the **Job List**.
3. In the **Properties** tab, select **MrSID Generation 4** from the **Output Format** drop-down.
4. In the **Properties** tab, click **More Options**.
5. On the **Compression** tab, select the **Per Band** radio button.
6. Click **Select Bands**.
7. Select one or more bands from the list and enter a compression ratio in the **Compression Ratio** text field. Alternatively, select the **Lossless** check box for the selected bands.
8. Click **Apply to Selected** to set the compression ratio for the selected bands.
9. Click **OK**.

The RGB Color Transform

For multispectral images, you can select the **RGB Color Transform** option to set the first three bands of an image as the RGB bands. When you set the first three bands of the image as the RGB bands, GeoExpress optimizes the image compression ratio of each one of the RGB bands to create a smaller image without sacrificing visual quality. If you select the **Lossless** option, GeoExpress does not optimize the compression ratio of the RGB bands.

If the first three bands of the image are not the RGB bands, change the order of the bands before you apply the RGB color transform.

By default, GeoExpress matches the colorspace of the output image to the colorspace of the input image. When you change the compression method of an image to per-band compression, GeoExpress does not apply the RGB color transform by default.

Specifying a Target File Size

Specify a target file size for a raster image to create an output image whose file size equals the target file size. You can specify a target file size for MrSID Generation 3 and Generation 4 images.

1. Click the **Add Image** icon  to add an image to the **Job List**.
2. Select the image in the **Job List**.
3. In the **Properties** tab, select **Target File Size** in the **Compression Method** drop-down.
4. Enter the target file size in megabytes in the text field.

Using Lossless Compression

Use lossless compression to compress an image or point cloud as much as possible without discarding any data. You can use lossless compression to create MrSID Generation 3, MrSID Generation 4, JPEG 2000, and LAZ images.

Lossless compression typically yields a 2:1 compression ratio which yields a 50% reduction in the file size. Use lossless compression when you need the compressed file to be identical to the original file.

1. Click the **Add Image** icon  to add an image or point cloud to the **Job List**.
2. Select the image or point cloud in the **Job List**.

3. In the **Properties** tab, select the **Lossless** radio button.

> *NOTE: If you compress an image that has already been compressed, you can select the **Lossless** radio button to ensure that GeoExpress does not discard any additional data.*

Using Quantization for Floating Point

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.

To compress a floating point image with the quantization compression method, complete the following steps:

1. Click the **Add Image** icon  to add a floating point image to the **Job List**.
2. Select the image in the **Job List**.
3. In the **Properties** tab, click **More Options**.
4. Select **MrSID Generation 4** as the output format.

   GeoExpress selects the **Quantization** compression method automatically for floating point images.
5. Optionally, click the **Set Quantization** button to configure quantization precision and other quantization options.

For more information on quantization options, see *Quantization Options* on page 116.

Chapter 6: Image Manipulation

Image Manipulation Overview

All manipulation operations are for raster images only with the exception of editing metadata. Use the toolbar to perform image manipulation operations. You can perform the following image manipulation operations:

- Edit metadata for an image. Edit the metadata of a raster image to include custom information in the image. Edit the metadata of a LiDAR point cloud to edit the coordinate reference system information. You can edit the metadata of MrSID and JPEG 2000 files.
- Despeckle an image. Remove speckling from MrSID and JPEG 2000 images.
- Crop an image. Select the area of an image that you want to keep and discard the other areas.
- Select an area of interest for an image. Specify part of an image as an area of interest. You can change the compression ratio of the area of interest to preserve more image detail in that part of the image or to blur that part of the image.
- Adjust the color balance for an image. Edit the brightness, contrast, and gamma values for an image. You can also change the values for each band in an image.
- Reproject an image. Change the projection used by the image. You can specify a custom well known text (WKT) string or select a standard coordinate reference system.

Image manipulation operations only take effect after you run the job for the image.

The Edit Metadata Tool

Use the **Edit Metadata** tool to edit the metadata of images and LiDAR point clouds. You can also use the tool to view the existing metadata of raster images.

For raster images, the following list describes the types of metadata that you can edit in GeoExpress:

- **User**. Custom metadata fields that you can use to store comments, information about your organization, and any other information that you find useful. You can edit user metadata for any image.
- **Image**. Metadata fields that describe the image, including the image location, resolution, and other metadata. You can edit image metadata for images with the MrSID and JPEG 2000 output formats.
- **NITF**. Metadata fields that describe the image file header, subheader, and security fields. You can edit NITF metadata for images with the NITF output format.

For LiDAR point clouds, you can only edit coordinate reference system metadata.

Editing Raster Metadata

The types of metadata that you can edit depend on the output format that you select for an image.

1. Select one or more jobs in the **Job List**.
2. Click the **Edit Metadata** button  in the toolbar.

   The **Metadata Manager** appears.
3. To edit user metadata, ensure that the **User** tab of the **Metadata Manager** is selected.
   - Add user tags by clicking **Add User Tag**, then entering a name and value for the tag. Alternatively, select an existing tag name from the drop-down.
   - Edit the values of existing tags by clicking the value field and entering another value.

   NOTE: Tag names cannot contain spaces, and tag values cannot be empty. Existing tags can be deleted but cannot be renamed.

4. To edit image metadata, click the **Image** tab of the **Metadata Manager**.
   - Save the image's coordinate reference system in the metadata by clicking **Select a Coordinate Reference System** or entering a custom well known text (WKT) string in the **WKT** text field.

     For more information on selecting a coordinate reference system, see *Selecting a Coordinate Reference System* on page 86.
   - Edit the image origin, image resolution, and dynamic range.

   *NOTE: Selecting a coordinate reference system in the **Metadata Manager** does not reproject the image.*
5. To edit NITF metadata, click the **NITF Options** tab in the **Metadata Manager**.
   - Edit the file header and file security fields in the **File Header** subtab.
   - Edit the image subheader, image comments, and image security fields in the **Image Subheader** subtab.
6. Click **OK**.

NOTE: Some existing JPEG 2000 images are encoded in such a way that certain decoders may fail to display them if you edit their metadata. To accommodate these images, GeoExpress handles several JPEG 2000 parameters in a special way. If you are editing the metadata of existing images and wish to change parameters for tile length markers, packet length markers, or tile parts, you must change them on the JPEG 2000 tab of the Preferences dialog. (For more information see JPEG 2000 Preference Options on page 171 and Advanced JPEG 2000 Options on page 133.)

Editing LiDAR Metadata

For LiDAR point clouds, you can edit the coordinate reference system (CRS) stored in the file metadata.

1. Select one or more jobs in the **Job List**.
2. Click the **Edit Metadata** button  in the toolbar.

   The **LiDAR Metadata** dialog appears.
3. Begin typing the name of a CRS or an EPSG code in the **Coordinate Reference**

System field.

A list of catching coordinate reference systems appears.

4. Select the CRS from the list.
5. Alternatively, select the **Use custom WKT** check box and paste a well known text (WKT) string into the text box.
6. Click **OK**.

Viewing Metadata

For raster images you can view existing metadata.

1. Select a job in the **Job List**.
2. Click the **Edit Metadata** button  in the toolbar.

   The **Metadata Manager** appears.
3. Click the **Viewer** tab.

   The image metadata appears.
4. If an image has geographic markup language (GML) embedded in the metadata, select the **GML** option to view the GML.
5. Click **OK**.

NOTE: To view sample metadata, see Sample MrSID Metadata on page 207.

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, and a small subset of these

are available for editing.

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.

Coordinate Reference System and WKT

You can assign a WKT to the image that identifies its coordinate reference system. This is useful when you know the CRS of an image but that data isn't captured anywhere in the file. It's also useful if the WKT is incorrect and you need to correct it.

> *IMPORTANT: Setting the WKT in the metadata of an image does NOT reproject the image. It only identifies where the image already is. To reproject an image to a new CRS, use the reprojection tools. Additionally, carelessly changing the WKT of an image may make the image inaccurate or unusable in any GIS applications that rely on this information.*

Image Origin

These X and Y fields can be used to set the *x,y* location of the image.

Image Resolution

These X and Y fields can be used to set the *x* and *y* resolutions of the image.

Dynamic Range

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

> *NOTE: If you select MrSID Generation 4 as the image output format, dynamic range values are calculated automatically for all images except for eight bit images. If you want to enter the dynamic range values manually for those images, change the method for generating the dynamic range to* ***None*** *in the* ***Format-Specific*** *tab of the* ***Advanced Job Options*** *dialog. For more information on calculating the dynamic range, see* *Dynamic Range Metadata Generation on page 125.*

The dynamic range metadata is particularly useful for images that only use a small portion of their datatype bandwidth. For example, 11-bit images are often stored as 16-bit images, where the upper five bits are left empty. The only bits that are meaningful are the first eleven. The full dynamic range of pixel values in an unsigned 16-bit image runs from 0 to 65535. The first eleven bits fall between 0 and 2047, which is only 3% of the full range! When you look at the histogram of this image (for information on histograms see *The Color Balance Tool* on page 79), all of the values will be gathered into the far left side, causing the image to appear black when it's scaled to display on a computer monitor. For an 11-bit image, the minimum value would be 0 and the maximum value would be 2047 (2^{11} - 1).

An alternate way to think of dynamic range is "window and level." The window is the width of data that's important and the level is where the midpoint of the window lies within the entire range. For our 11-bit image, the window, or width, is 2048 (2^{11}), and the level, or midpoint, is 1023.5 ((2^{11} -1) / 2). The window and level are displayed next to the Min and Max fields to aid you in setting the dynamic range.

To set the dynamic range of the image, type the minimum pixel value in the Min field and the maximum pixel value in the Max field.

IMPORTANT: Setting the dynamic range does not change the pixel data of the image. It only gives clues as to how the image should be displayed. Some applications may honor this value and some may ignore it, depending on how the pixels need to be represented for a given workflow. Additionally, setting the dynamic range is not the same as color balancing. Color balancing changes the actual pixel values, which changes the nature of the image. (For more information see Performing Color Balancing for a Mosaic on page 151.)

Viewable Image Metadata

In addition to the image metadata that you can edit, 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 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 metadata tags. Both tools are included on the GeoExpress DVD.

General 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 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
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.

Tag	Description	Notes
		Values are stored in the data-type 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 areas 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)	

Tag	Description	Notes
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-Only Tags

The 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)	
IMAGE::COMPRESSION_NLEV	Number of zoom (res-olution) 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

Tag	Description	Notes
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-Only 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 *Quantization Precision* on page 117.

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.

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 the following URL:

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:

File Header Fields

NITF Field	GeoExpress Tag
FHDR	`NITF::FH000::FHDR`
FVER	`NITF::FH000::FVER`
STYPE	`NITF::FH000::STYPE`
OSTAID	`NITF::FH000::OSTAID`

NITF Field	GeoExpress Tag
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

Of the above, GeoExpress allows the user to 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:

Security-Related Fields

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

NITF Field	GeoExpress Tag
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 the user to custom set all of the above.

Image Segment Fields

GeoExpress stores image segment fields in the following tags:

Image Segment Fields

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

NITF Field	GeoExpress Tag
ICOM1	NITF::IM001::ICOM1
...	...
ICOM9	NITF::IM001::ICOM9

GeoExpress allows the user to custom set these image segment fields: IID1, IDATIM, TGTID, IID2, ISORCE, NICOM, ICOM1...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 following tag:

  NITF::IM001::TRE_USE00A

- explicitly recognizes the following TREs when reading in a NITF file:

  J2KLRA, USE00A, STDIDC, PIAIMC, 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

  ...

Metadata Templates

To assist in editing the user metadata of multiple images, the **Metadata Manager** allows metadata templates to be saved and applied to one or more images. A metadata template contains all of the tags and values that you wish to apply to a given image or images.

Metadata templates are created, edited, saved, retrieved and applied in the **Metadata Template Editor**.

Accessing the Metadata Template Editor

1. Select one or more jobs in the **Job List**.
2. Select **Metadata** from the **Options** on the menu bar.

   The **Metadata Manager** dialog box appears.
3. Click **Metadata Templates** at the bottom left.

   The **Metadata Template Editor** appears.

Selecting or clearing the check box associated with a value or set of values enables or disables the given tag.

The image tags are the same as those in the Metadata Manager except that you can choose to save any or all of these in the template.

Creating a Tag in the Template Editor

1. Click in the name or value cell of the row that starts with an asterisk.
2. Start typing in the **Name** and **Value** fields.

   Tag names cannot contain spaces and tag values cannot be empty.

Deleting a Tag in the Template Editor

1. Select the entire tag by clicking the gray cell at the far left of the row.
2. Press the **Delete** key.

Saving a Template

1. Click the **Save Template** button.

   The **Save Metadata Template** dialog appears.
2. Enter a name for the template and click **OK**.

Loading a Template

1. Click the **Load Template...** button. The Load Metadata Template dialog appears.
2. Choose a template from the drop-down list and click **OK**.

Deleting a Template

1. Choose the template in the **Load Metadata Template** or **Save Metadata Template** dialog.
2. Right-click the template name and click **Delete this template**.

Applying a Template

1. Create a template or load a template in the **Metadata Template Editor**.
2. Click **Apply Template**.

The Despeckle Tool

If you need to make images with higher compression ratios, use the **Despeckle** tool to minimize compression artifacts.

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 (MG4), or to losslessly encode source images to MrSID Generation 3 or JPEG 2000.

> *IMPORTANT: 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 con-

tained within a single polygon (for example, an image of a series of islands cannot be despeckled).

By default, images are not despeckled upon encoding. Further, despeckling is not recommended for images without a collar. To despeckle images by default for the MrSID or JPEG 2000 formats, set the despeckling option in the preferences. For more information on preferences, see *Preferences* on page 159.

> *NOTE: Some existing JPEG 2000 images are encoded in such a way that certain decoders may fail to display them when despeckled with GeoExpress' default settings. To accommodate these images, GeoExpress handles several JPEG 2000 parameters in a special way. If you are despeckling images using the Despeckling tab and wish to change parameters for tile length markers, packet length markers, or tile parts, you must change them on the JPEG 2000 tab of the Preferences dialog. (For more information see JPEG 2000 Preference Options on page 171 and Advanced JPEG 2000 Options on page 133.)*

Despeckling an Image

When you select a single job for despeckling, the image is displayed in the preview area of the dialog. If you select multiple jobs, the preview pane and navigation buttons are not displayed. You can despeckle images with the MrSID Generation 4, MrSID Generation 3, or JPEG 2000 output format.

1. Add a source image or mosaic to the **Job List**.
2. Click the **Despeckle** button  on the toolbar.
   The **Despeckle Options** dialog box appears.
3. Select the **Despeckle Output** check box.
4. Optionally, enter threshold and point spacing values by typing them in the edit fields or using the slider controls (see below for information about these values). **Note:** The sliders only move within the recommended range (1-127 for threshold and 6-12 for point spacing), but you may enter any integer greater than zero in the fields.
5. Optionally, to preview the effects of the threshold at different settings select the **View Threshold** check box and then move the **Threshold** slider. Black areas are pixels whose

values fall below the threshold and will be used to determine the despeckling collar of the image.

6. Click **OK**.

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.

By default, the threshold 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. By default, the point spacing value is 6.

The Image Crop Tool

Use the **Image Crop** tool to crop a region from any raster image in the **Job List** whether it is a single image or an image mosaic.

To define the area of an image that you want to crop, draw a rectangle on the preview image or select a shapefile with one or more polygons. If the shapefile contains multiple polygons, you can either create a single output image that contains all of the polygon crop areas, or you can create a separate output image for each crop area. Multiple output images are saved according to the following naming convention:

```
<output file name>_<column label>_<polygon ID>
```

For example, if you select Washington as the output file name, and the shapefile polygons have a column for counties, one of the output files would have the following name:

```
Seattle_KingCounty_1.sid
```

> *NOTE: If you crop existing MrSID and JPEG 2000 images but do not compress the images again, you do not use data from the data cartridge.*

Cropping by User-Defined Rectangle

You can select a crop region by entering values for the image extents. Alternatively, click **Show Image** to display an image preview and draw a rectangle of the area that you want to crop.

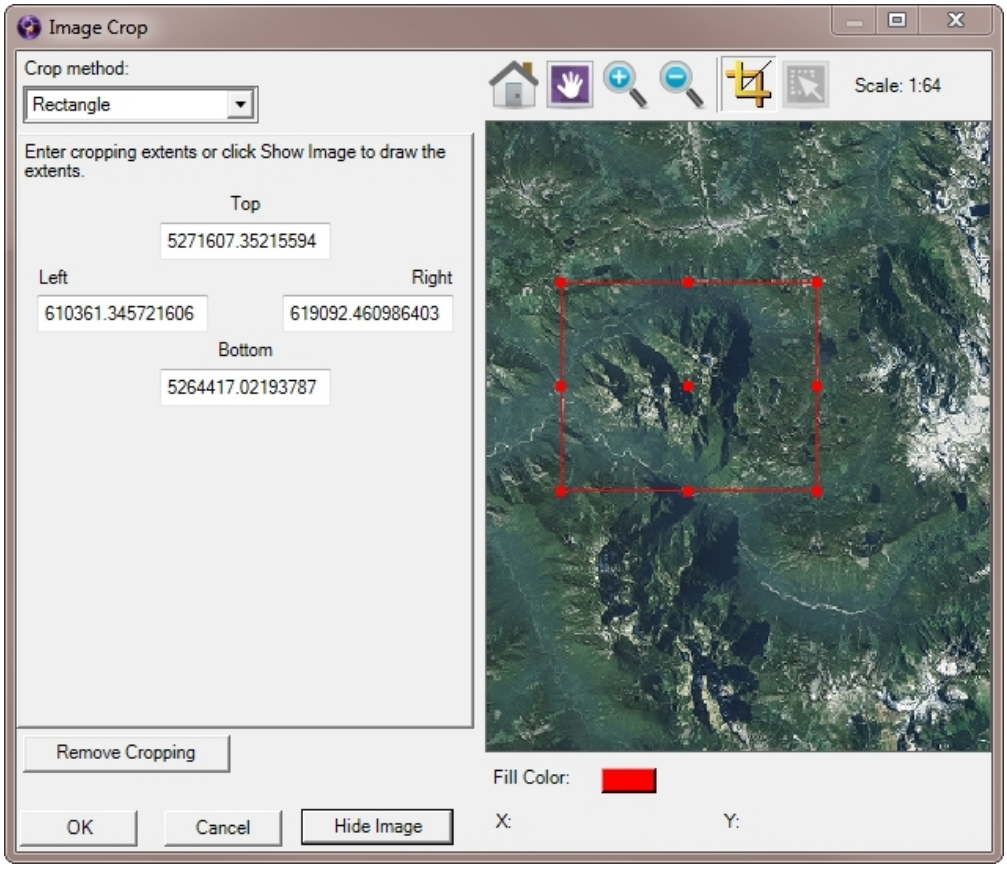
To manually enter the cropping extents, complete the following steps:

1. Select an image or mosaic in the **Job List**.
2. Click the **Image Crop** button  on the toolbar. The **Image Crop** dialog box appears.
3. Enter the cropping extents, then click **OK**.

To define the crop region by drawing a rectangle, complete the following steps:

1. Select an image or mosaic in the **Job List**.
2. Click the **Image Crop** button  on the toolbar. The **Image Crop** dialog box appears.
3. Click the **Show Image** button at bottom right.
4. Use the zoom in, zoom out and other tools from the image crop toolbar to position the image.
5. Click the **Crop** button on the image crop toolbar.

6. Draw a rectangle on the image to define the crop region as shown below.



7. Optionally, adjust the rectangle using the corner or center handles.
8. Click **OK**.

The extents of the original image are displayed in the **Image Extents** panel on the **Properties** tab for easy reference.

Cropping by Shapefile

GeoExpress allows you to crop images using a shapefile with one or more polygons. If the shapefile contains more than one polygon, you must select the polygons that you want to use to crop the image.

1. Select an image or mosaic in the **Job List**.
2. Click the **Image Crop** button on the toolbar.
3. In the **Crop Method** panel, select the **Shapefile** option.

4. Click **Browse** to select the shapefile that you want to use.

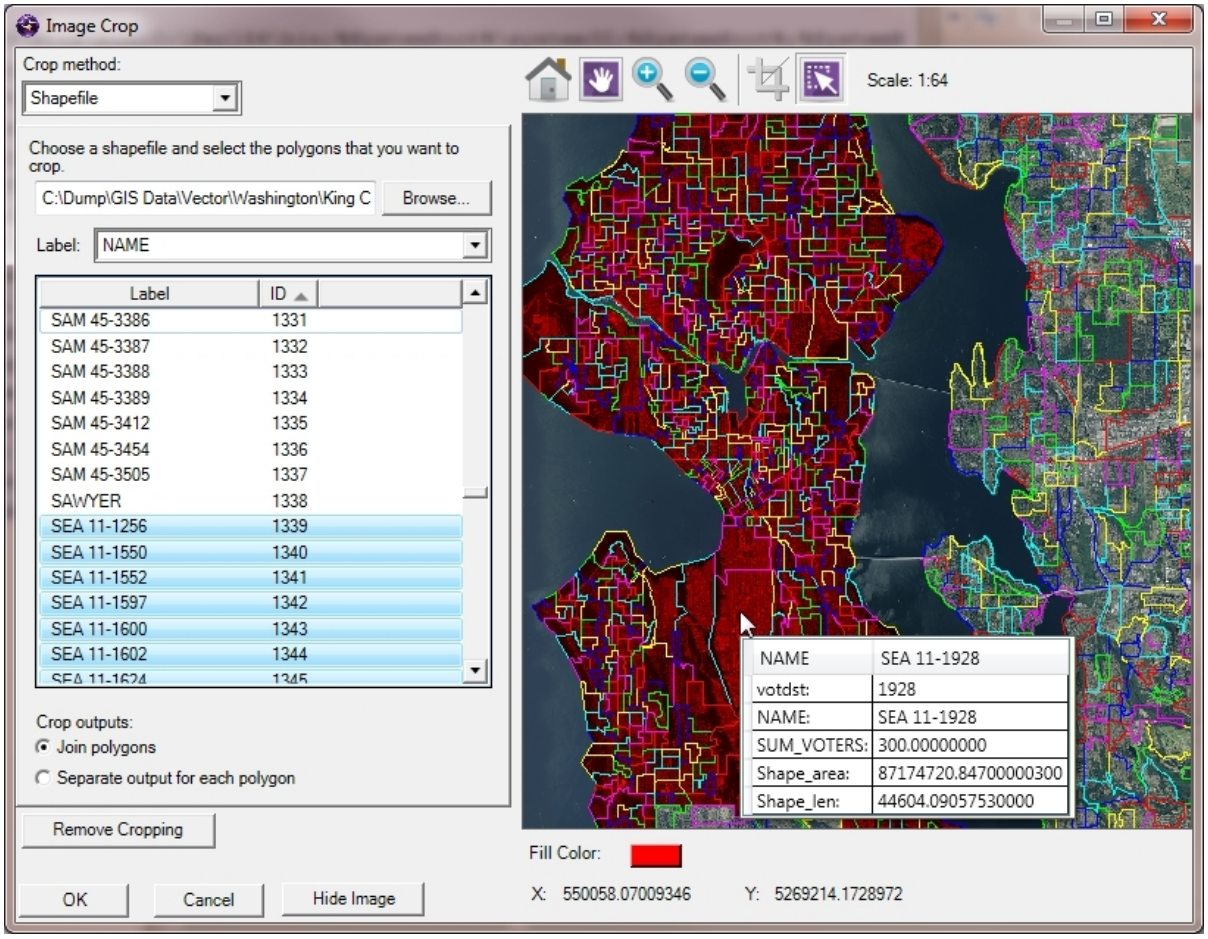
   A list of the polygons in the shapefile appear in the table. By default, if the polygons have a name property, the names are displayed as the label in the table.

5. Optionally, use the **Label** drop-down to select the shapefile property that you want to display in the table as the label.

   For example, you might select a property named Voting District to know which polygons you want to select.

6. Select the polygons that you want to use for cropping in the table.

   Alternatively, use the **Select Features** button  to select polygons in the preview pane. For both the table and the preview pane, you can press the **Control** key to select multiple polygons. Additionally, when you use the select feature tool, you can right-click on a polygon in the preview pane to display its properties in a table.



7. If you selected multiple polygons, select whether you want to join the cropped regions for each polygon into a single output image, or you want to create a separate output image for each polygon crop region.

8. Optionally, click **Show Image** to preview the crop area or areas on the source image.

NOTE: Cropping by shapefile is not supported when the output format is JPEG 2000 and the input image has multiple bands.

The Area of Interest Tool

The Area of Interest (AOI) encoding feature 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” (lower compression) areas or “blurred” (higher compression) areas. 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 more detail is preserved within that area.

GeoExpress offers three methods of encoding an area of interest: the weight, shift and mask methods. GeoExpress enables you to encode an area of interest in MG3, MG4, or JPEG 2000 format. When the output format selected is JPEG 2000, any method can be used. MrSID encoding requires the weight or mask method. For more information about using these methods, see *MG3 and MG4 Area of Interest Encoding* on page 74 and *JPEG 2000 Area of Interest Encoding* on page 75.

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

- the desired output format – MG3, MG4, or JPEG 2000
- 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).

Defining Areas of Interest

You may define areas of interest in GeoExpress by vector overlay or by drawing a single rectangle. 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.

1. Select a job in the **Job List**
2. Click the **Area of Interest** button  on the toolbar.

   The **Area of Interest** dialog box appears.
3. To view the image while setting area of interest parameters, click the **Show Image** button

Drawing a Single Rectangular Area of Interest

A single rectangle can be used to express an area of interest either as the foreground or background (see *Inner and Outer Areas* on page 73).

You can define a single rectangle either by entering values for offsets, *x* and *y* positions, or x and y positions with width and height, or by drawing a rectangle across the image with the Draw Area tool. The Draw Area tool is not accessible unless the image is shown.

To enter numerical values to define a single rectangular area of interest:

1. Access the **Area of Interest** dialog as described above.
2. Select the **User Defined Rectangle** radio button.
3. Select the format of the rectangle by selecting the radio button for **Edge offset**; **Upper left, lower right**; **Upper left, width, height**; or **Center, width, height**.

4. Change the unit of measurement if desired by selecting the **Pixels** or **Geospatial coordinates** radio button.
5. Enter values in the fields to the right.
6. Select other desired parameters and click **OK**.

To use the **Draw Area** tool to define a single rectangular area of interest:

1. Access the **Area of Interest** dialog as described above and click **Show Image**.
2. Select the **User Defined Rectangle** radio button.
3. Click the **Draw Area** icon  above the image window.
4. Click and drag on the image to define a rectangle as shown above.
5. Adjust the shape and size of the rectangle by clicking and dragging the “handles” at the sides and corners; adjust its position using the middle handle. Offset or other positioning values are automatically filled in.
6. Select other desired parameters and click **OK**.

Using Vector Overlays to Define Areas of Interest

GeoExpress supports vector overlays of Esri Shapefile (*.shp), MapInfo TAB (*.tab), and GML version 2 (*.gml) formats. Vector overlays must be in the same coordinate system as the input image file and must contain closed polygons in order to be valid. GeoExpress uses all valid shapes within the active layer as the combined area of interest; individual shapes within the active layer cannot be turned on or off.

Area of interest options set by the user apply to all shapes in the active layer.

Vector overlays are not editable within GeoExpress.

To use a vector overlay to define an area of interest:

1. Access the **Area of Interest** dialog as described above.
2. Select the **Vector Overlay File** radio button.

   A panel of vector overlay options appears in the middle of the dialog box.

3. Enter a file path in the **Vector Overlay File** field or click **Browse to search your directories**.
4. Select an active layer from the drop-down list if necessary. GeoExpress supports only a single layer of a given vector overlay. By default the first layer is taken.
5. Select any other desired parameters and click **OK**.

To remove a currently listed vector overlay click **Remove Vector Overlay File**.

If a vector overlay is selected and Show Image is selected, the shapes will be drawn on top of the input image in the image window. Filling in the shapes may give you a better idea of the areas they define by displaying the shapes as solid polygons.

To fill in the areas of interest, select the **Fill Shapes** check box below the image window.

The outline color for the drawn shapes can be customized by clicking the "Outline Color" button. The line width for the drawn shapes can be set on the **Appearance** tab of the **Preferences** dialog box. Changing the outline color and line width has no affect on the resulting encoded image, and is only used for previewing purposes.

NOTE: 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.

Inner and Outer Areas

All regions inside specified areas of interest are called "foreground". All surrounding regions are called "background". The Inner and Outer radio buttons correspond respectively to foreground and background and enable you to choose which part of an image the AOI processing will affect.

In MrSID encoding, "inner" and "outer" are not specifically referred to except when using the mask method, as noted below. Either the foreground or background is given preference by the difference in weight between them as specified by the compression ratio of the foreground and that of the area(s) of interest.

In JP2 encoding using the weight and shift methods, selecting the "Weight Inner" or the "Shift Inner" button preserves the quality of the foreground at the expense of the surrounding regions. Similarly, selecting "Weight Outer" or "Shift Outer" preserves the quality of the background at the expense of the foreground.

The mask method renders either the foreground (by selecting the Inner check box) or background (by selecting the Outer check box) as a solid color.

Using Area of Interest with Image Crop

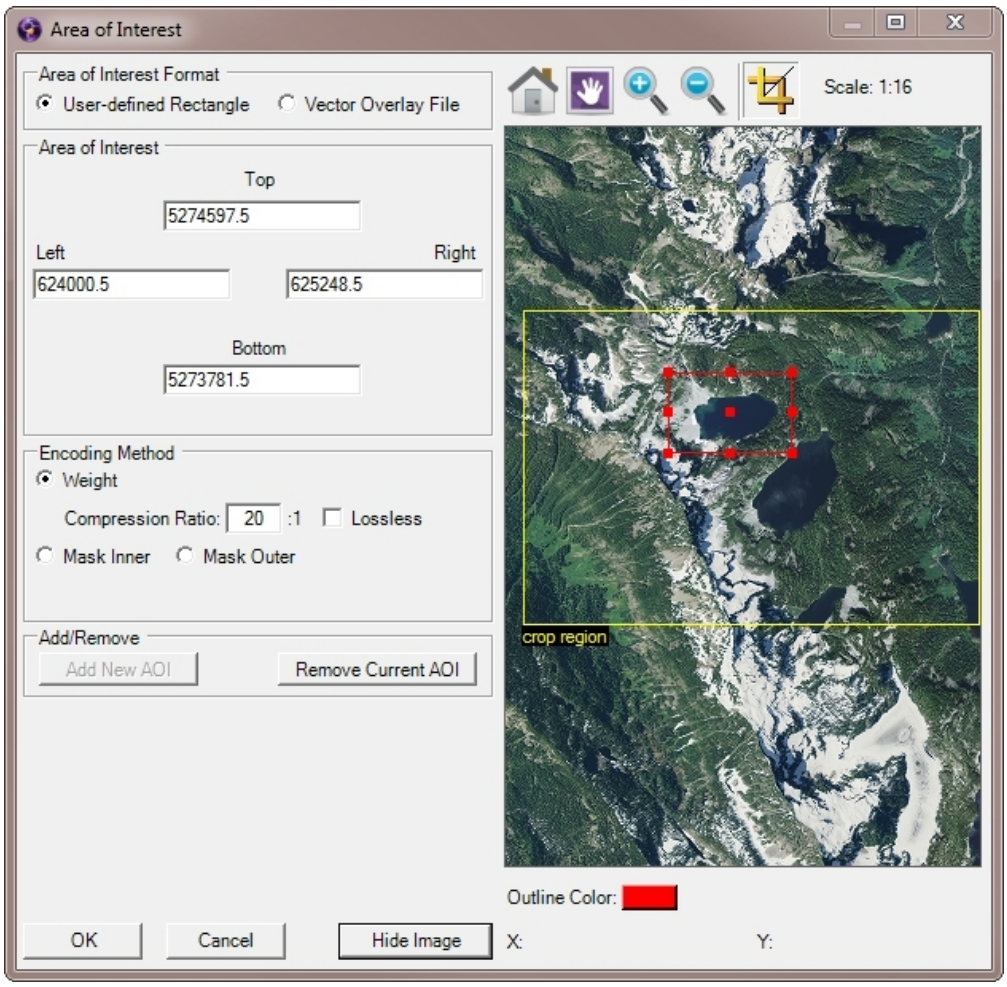
GeoExpress is designed to accommodate a workflow that demands a number of image customizations at a single encode. Accordingly, it is possible to crop an image and encode an area of interest at the same time. A useful workflow would be to first define a crop region in an image and then define an area of interest.

To specify your area of interest in relation to an existing crop region:

1. Select **Area of Interest…** from the **Tools** menu.
2. Click **Show Image** for an image on which you have already defined a crop region (see *The Image Crop Tool* on page 64). The region you defined appears marked out in lines and labeled as the crop region.
3. Define your area of interest and encode.

You can specify an area of interest anywhere in the image, regardless of whether or not it is in the crop region. Obviously, areas of interest defined outside a crop region will not appear in the results for the cropped version of the image, but this may be a desired effect since a project can be used for multiple operations.

In the illustration below, an area of interest is being drawn within an existing crop region.



Inner and Outer Areas

All regions inside specified areas of interest are called “foreground”. All surrounding regions are called “background”. The Inner and Outer radio buttons correspond respectively to foreground and background and enable you to choose which part of an image the AOI processing will affect.

In MrSID encoding, “inner” and “outer” are not specifically referred to except when using the mask method, as noted below. Either the foreground or background is given preference by the difference in weight between them as specified by the compression ratio of the foreground and that of the area(s) of interest.

In JP2 encoding using the weight and shift methods, selecting the “Weight Inner” or the “Shift Inner” button preserves the quality of the foreground at the expense of the surrounding regions.

Similarly, selecting “Weight Outer” or “Shift Outer” preserves the quality of the background at the expense of the foreground.

The mask method renders either the foreground (by selecting the Inner check box) or background (by selecting the Outer check box) as a solid color.

MG3 and MG4 Area of Interest Encoding

GeoExpress offers two methods, the weight and mask methods, for encoding an area of interest with MG3 or MG4 as the output format.

TIP: Area of interest encoding of MG3 and MG4 images can be done more quickly if the images were originally encoded as optimizable. For more information, see *Optimizable on page 130.*

NOTE: Area of interest encoding in MG3 format automatically uses the 2-Pass optimizer, even if its check box on the ***Format-Specific*** *tab of the* ***Advanced Job Options*** *dialog box has not been selected. For more information, see* *1-Pass or 2-Pass Optimizer on page 129.*

Methods

The Weight Method

The weight method is the default for encoding areas of interest with GeoExpress. (This is not to be confused with the weight parameter in the advanced job options.) The parameters for using the weight method differ depending on the output format. MG3 and MG4 require the user to enter 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. Selecting the weight radio button enables you to specify an encode ratio for the area of interest or select the **Lossless** check box. The outside area will be encoded at the compression ratio specified in the **Job Options** dialog. These ratios are used in a calculation of the overall image compression.

The calculated filesize appears on the **Properties** tab for the image once you close the **Area of Interest** dialog box.

The Mask Method

The mask method renders either the foreground or the background as a solid color, completely obscuring (actually removing) the underlying image data.

The mask method only applies to encode jobs and is not available for optimizations.

To mask any area(s) inside the AOI polygon(s) (foreground), select **Mask Inner**.

To mask any region(s) outside the AOI polygon(s), select **Mask Outer**.

Mask Color

To specify or change the mask color, select either **Mask Inner** or **Mask Outer**, then click **Mask Color**. The **AOI Mask Color** dialog box appears.

By default the mask color is black. Black drives all pixel values to the minimum supported value (usually zero), while white drives all pixel values to the maximum supported value (e.g. 255 for an 8-bit image). You can also specify a custom 8-bit RGB color value.

To specify a custom 8-bit RGB color value, select the **Custom** option and fill in the red, green and blue values.

Reading the Log File

The compression ratios for the inside and outside of the area of interest are reported in the GeoExpress log file after you run the area of interest job. For more information on log files, see *Viewing and Using Log Information* on page 177.

JPEG 2000 Area of Interest Encoding

GeoExpress offers three methods, the weight, shift and mask methods, for encoding an area of interest (AOI) with JPEG 2000 (JP2) as the output format. Also, the weight and shift methods can favor the “inner” or “outer” area (for more information see *Inner and Outer Areas* on page 73).

Methods

The Weight Method

In JPEG 2000 encoding the weight value controls the image quality of the foreground relative to the background or vice versa: larger values will result in a higher quality foreground and a lower

quality 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.)

Using the Weight Method

1. Click the **Area of Interest** button  on the toolbar (or select **Area of Interest…** from the **Tools** menu) to access the **Area of Interest** dialog box.
2. Define an area of interest by one of the following methods (for more information see *Defining Areas of Interest* on page 69):
   - using a vector overlay
   - drawing or entering values for a single rectangle
3. Select **Weight Inner** or **Weight Outer**.

   The **Value** field appears with the default value of 100.
4. Change the default value if desired.
5. If desired, choose a number of resolution levels to be included in the AOI process from the drop-down list. The default is all levels, but you may choose any number equal to or less than the number of resolution levels the image includes (see *Zoom Options* on page 108). For example, if the image is being encoded to have five resolution levels, then you may choose five or less and the default would be all five levels.
6. Click **OK**.

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.

The Shift Method

The shift method is an alternative way to express the encoding of an area of interest when JP2 is selected 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 73). 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.

Using the Shift Method

1. Click the **Area of Interest** button  on the toolbar (or select **Area of Interest…** from the **Tools** menu) to access the **Area of Interest** dialog box.
2. Define an area of interest by one of the following methods (for more information see *Defining Areas of Interest* on page 69):
   - using a vector overlay
   - drawing or entering values for a single rectangle
3. Select **Shift Inner** or **Shift Outer**.

   The **Value** field appears.
4. Enter a shift value.
5. If desired, choose a number of resolution levels to be included in the AOI process from the drop-down list. The default is all levels, but you may choose any number equal to or less than the number of resolution levels the image includes (see *Zoom Options* on page 108). For example, if the image is being encoded to have five resolution levels, then you may choose five or less and the default would be all five levels.
6. Click **OK**.

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

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 *The Mask Method* on page 75).

The Mask Method

The mask method in JPEG 2000 is the same as in MrSID area of interest encoding. See *The Mask Method* on page 75.

Number of AOI Levels

This parameter controls the number of resolutions levels subject to the area of interest encoder process in the shift and weight methods; this can be used to alleviate the “stepping” effect mentioned above. When “Number of AOI 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.

For information on viewing the results of encoded areas of interest, see *Reading the Log File* on page 75.

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 on the **Format-Specific** tab of the **Advanced Job Options** dialog box (see *Advanced JPEG 2000 Options* on page 133).

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 JPEG 2000 area of interest encoding may require a trial and revision process.

Area of Interest Scenarios

Increased Visual Quality in Area of Interest

A city government has an area that will be under construction with a new housing development. The contractor needs access to high-quality imagery in the construction zone. The contractor will need the remainder of the imagery at a lower quality in order to overlay existing roads, etc. The city has an existing composite MrSID Generation 3 (MG3) mosaic of MrSID imagery created from 100 smaller MG3 images compressed at a ratio of 20:1. The city will import a vector overlay that outlines the area of construction and would like to specify a lossless compression ratio in this area (i.e. no additional loss after original 20:1 compression) and an additional 20:1 compression for the remainder of the image in order to reduce the file size of the deliverable and still meet the contractor's needs.

Decreased Visual Quality in Area of Interest

The United States Department of Defense (DoD) requires as a measure against terrorism that imagery over the nation's capital building and White House in Washington, DC, not be delivered in high resolution. In the past data providers have downsampled those areas of the images and mosaicked them back together, which can be time consuming. A data provider would like to load the mosaic of original TIFF files into GeoExpress, select a region, apply a 100:1 compression ratio over the selected region and 20:1 compression for the remainder of the mosaic.

Areas of Interest Defined for Faster Viewing

A Paris city employee working in the field with low bandwidth wants to view an extremely large image of Paris online through a viewing application. She is only interested in the portion of the image that shows the Eiffel Tower. If that portion of the image has been defined as an area of interest, it can be given display priority so that that area appears sooner, becoming crisp and clear before the rest of the image.

The Color Balance Tool

Use GeoExpress to perform color balancing operations for raster images when you select MG3, MG4, or JPEG 2000 as the output format. You can color balance 8-bit and 16-bit unsigned gray-scale and RGB images. You can also color balance mosaics and multiple images at a time. There are three types of corrections that you can apply: uniform corrections, non-uniform corrections, and automatic corrections.

For information about color balancing and mosaics, see *Performing Color Balancing for a Mosaic* on page 151. For information about color balancing many images at a time, see *Performing Batch Color Balancing* on page 82.

Uniform Corrections

You can apply uniform corrections to single images and mosaics. Uniform corrections affect the brightness and contrast of all pixels in the same way, so light spots will still be light and dark spots will still be dark regardless of the corrections that you apply.

In the **Uniform Corrections** tab, select the bands for which you want to perform corrections and use the sliders to adjust gamma, brightness, and contrast values.

Non-Uniform Corrections

You can apply non-uniform corrections to mosaics only. Non-uniform corrections adjust the color values of specific portions of each mosaic tile. Use non-uniform corrections when each tile in a mosaic has similar flaws. For example, when one side of each tile is light and the other side is dark. When you combine multiple images with similar imperfections, the flaws become very noticeable. To correct these patterns across a mosaic, use non-uniform corrections.

The following list describes the three types of non-uniform corrections:

- **Vignette correction**. Corrects color inconsistencies caused by a camera lens. Use vignette correction when your images display a lower light intensity around their edges. The correction automatically normalizes the highlights and dark spots across tiles to create a mosaic that appears more unified. Vignette correction affects all the tiles in the mosaic.
- **Tilt correction**. Corrects bidirectional reflectance. Bidirectional reflectance describes the effect of the angle of the sun on an image. Use tilt correction when the images in a mosaic were all taken under similar lighting conditions. For example, your images may be darker on one side than the other. When you apply tilt correction to all the tiles in a mosaic, GeoExpress matches the color levels of each tile in the mosaic. Tilt correction affects all the selected tiles in a mosaic.
- **Seam line correction**. Corrects discrepancies in the edges of tiles in a mosaic. Use seam line correction to smooth the transitions between tiles. Depending on the geometry of a given mosaic, sometimes seam lines cannot be generated. In that case, the **Apply Seam Lines** option is unavailable. Seam line correction affects all the tiles in a mosaic.

NOTE: Tilt correction is computationally intensive. If there are many tiles in the mosaic, both the preview and the mosaic job may take more time to process.

Automatic Corrections

Automatic corrections adjust the color values of multiple images or mosaic tiles to match another image.

You can apply automatic corrections to single images and mosaics. If the corrections are going to be applied to multiple images, all the images must have the same number of output bands and the same data type. If you select **Duplicate job parameters**, this also applies to the image whose color corrections you want to match.

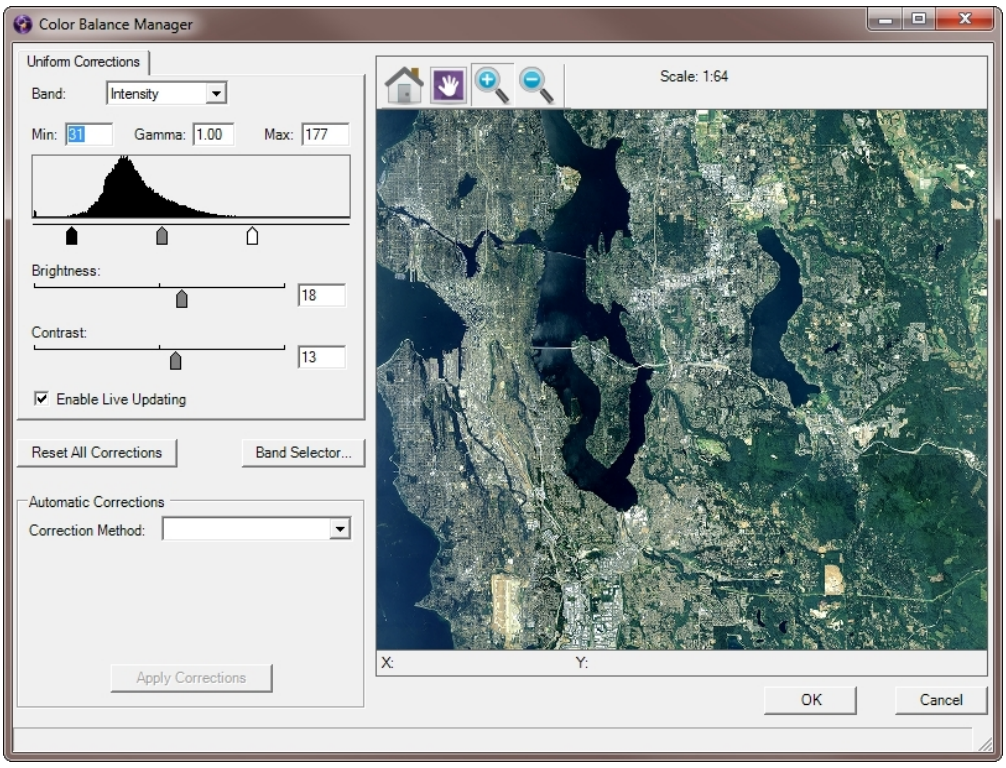
The following list describes the automatic correction methods that you can use:

- **Match tiles to each other**. Mosaics only. Sets the intensity of each tile in a mosaic to match the average of all tiles.
- **Match to a selected tile**. Mosaics only. Sets the intensity of the tiles that you select to match the color levels of a source tile that you specify. To specify a source tile, select a tile in the tile list and click **Set Selected Tile As Source Tile** in the **Automatic Corrections** panel. Then, select the tiles in the tile list to which you want to apply the corrections and click **Apply Corrections**.
- **Duplicate job parameters**. Matches the color balancing corrections applied to another image in the **Job List**. If you have not applied color balancing corrections to another job yet, GeoExpress displays a blank pane. Use this option to quickly apply color balancing corrections to many images at a time.
- **Match to histogram**. Matches the histogram values of another image that you select. GeoExpress calculates histogram values for the image that you select, including brightness, contrast, gamma, and more, then GeoExpress attempts to apply those values to the current image.

Performing Color Balancing for a Single Image

1. Select a single job from the **Job List**.
2. Click the **Color Balance** button  on the toolbar.

   The **Color Balance Manager** appears.



3. From the **Band** drop-down list select a band or **Intensity**.

   For grayscale images, only one band is available. Select an individual band to modify it individually or select intensity to modify all bands.

4. Make changes to histogram values by entering new values into the **Min**, **Max** and **Gamma** fields, or click and drag the slider controls below the histogram.
5. Click **OK**.

Performing Batch Color Balancing

To perform color balancing for many images at a time, you must first set the color balancing corrections that you want to apply to a single image. Then, you can apply those corrections to all the remaining images.

1. Add all the images that you want to color balance to the **Job List**.
2. Select one of the images from the **Job List**.
3. Click the **Color Balance** button  on the toolbar.

   The **Color Balance Manager** appears.

4. From the **Band** drop-down list select a band or **Intensity**.

   For grayscale images, only one band is available. Select an individual band to modify it individually or select intensity to modify all bands.

5. Make changes to histogram values by entering new values into the **Min**, **Max** and **Gamma** fields, or click and drag the slider controls below the histogram.
6. Click **OK**.
7. Select the remaining images that you want to color balance from the **Job List**. You can hold the **Shift** key to select a range of images.
8. In the **Automatic Corrections** panel, select **Duplicate job parameters** from the drop-down.

   The first image to which you applied color balancing corrections appears in a list below the drop-down.

   > *NOTE: The list only displays images to which you have applied color balancing corrections, and which have the same number of bands and the same data type as the images that you selected in the **Job List**. Additionally, the list does not display mosaics to which you have applied corrections, only single images.*

9. Click the first image to which you applied color balancing corrections.
10. Click **Apply Corrections**.
11. Click **OK**.
12. Click a blank section in the **Job List** to ensure that no jobs are selected.
13. Click **Run All Jobs**.

Histogram Values

GeoExpress displays the histogram for an image on the left side of the **Color Balance Manager**. The histogram control enables you to adjust the minimum, maximum, and gamma values for each band in the image.

The black slider represents the minimum pixel value, the white slider represents the maximum pixel value, and the gray slider represents the gamma value. The range of values for the minimum and maximum controls is based on the data type of the image. For example, for 8-bit images, the

range of values is 0 through 255. The maximum value cannot be less than or equal to the minimum value.

The gamma slider is restricted to a fractional position in between the minimum and maximum sliders. The range of gamma values is 0.102 – 9.99. The default value of 1.0.

The histogram controls adjust dynamically as the brightness and contrast values are changed.

To revert back to an image's original state, removing all color corrections, click **Reset All Corrections**.

Brightness and Contrast

Below the histogram control are two slider controls for modifying the brightness and contrast of the active band of the image. They accept integer values from -100 to 100, -100 being low brightness/contrast and 100 being high brightness/contrast. The histogram controls adjust dynamically as the brightness and contrast are changed.

Live Updating

The "Enable Live Updating" check box controls how the preview image is updated. If "Enable Live Updating" is selected, the image will update in real time as you manipulate the slider controls. If the update performance starts to slow down, as it may for very large mosaics, you can clear this check box to disable the live updating feature so that the image only updates after a dragging operation is complete (i.e. when the mouse button is released).

The Reproject Tool

The **Reproject** tool changes the projection of an image from one coordinate reference system (CRS) 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.

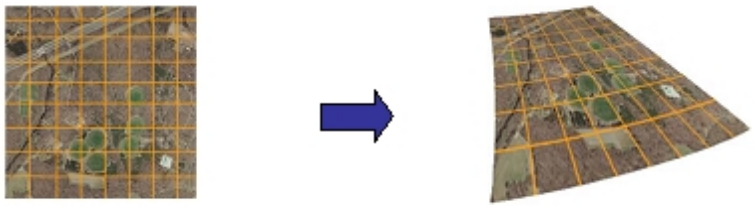
Coordinate reference systems are prearranged projections used in specific countries either in modern times or in historical maps. However, many states and counties within a country may employ a

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 10N. 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.

NOTE: Reprojection necessarily involves encoding since pixel data cannot be altered in compressed wavelet space.

Reprojecting an Image

To reproject an image, you must set a CRS for the source image and for the output image. You can reproject images to the MrSID Generation 4 (MG4), MrSID Generation 3 (MG3), JPEG 2000, and NITF 2.1 output formats.

1. Click the **Reproject** button  on the toolbar.

   The **Reprojection Manager** dialog box appears.

2. Select the **Reproject Image** check box at upper left.
3. If the source image has a known CRS, then that CRS is displayed. Otherwise, click **Select Coordinate Reference System** in the **Source Image** panel to select a source CRS.
4. To set the projection for the output image, click **Select Coordinate Reference System** in the **Output Image** panel.
5. Optionally, click **Advanced Options** to set additional reprojection options.
6. Click **OK**.

NOTE: When you reproject an image, you affect the image's pixel data. As a result, you should always reproject an image before you perform other image manipulation operations, especially cropping or defining an area of interest.

Selecting a Coordinate Reference System

Select the coordinate reference system by typing any part of it in the **System** field, such as the name of the state ("Utah") or an EPSG number ("4326") and then choose from the CRSs that appear as you type. You may alternatively select one of the CRSs you use most often by choosing it from the **Recently Used Systems** drop-down menu.

If a particular EPSG code is not available in the **System** field, select the **Use Custom WKT** check box and select an option from the **Select WKT** drop-down list. If you've already created and saved a custom well-known text string (WKT), you can choose it from this list. Otherwise, select **Add a new WKT** to create a new custom WKT that describes the CRS. You can paste a

WKT string in the **WKT** field, or you can use a text file or Esri CRS file (*.prj) as input by clicking **Browse**.

> *NOTE: For information on how to create a WKT, see the Open Geospatial Consortium (OGC) spec # 01-009 at http://www.geoapi.org/3.0/javadoc/org/opengis/referencing/doc-files/WKT.html. For a listing of common WKT strings, see http://www.spatialreference.org/.*

Editing a Custom WKT

1. Access the Coordinate Reference System Selector as described above.
2. Select the **Use Custom WKT** check box. The “Select WKT” drop-down list becomes available.
3. Select a WKT from the drop-down list and click **Edit WKT**. The "Edit User Defined WKT" dialog box appears as shown above.
4. Make changes to the text string and click **OK**.

Deleting a Custom WKT

1. Access the Coordinate Reference System Selector as described above.
2. Select the **Use Custom WKT** check box. The “Select WKT” drop-down list becomes available.
3. Select the WKT from the drop-down list and click **Edit WKT**. The "Edit User Defined WKT" dialog box appears as shown above.
4. Click **Delete this WKT**.
5. Click **OK**.

Advanced Reprojection Options

Resolution

To specify the output resolution of the reprojected image, select the **Set output resolution** check box and enter the *x* and *y* values in the edit fields. If the check box is left unselected, GeoExpress calculates the output resolution when it performs the reprojection.

This parameter has been made configurable in the event that experienced users require adjustments. However, adjusting the output resolution can have far-reaching effects and it is recommended that you allow GeoExpress to calculate it for you.

If you set the resolution manually and notice that the image is offset, select the **Align pixels with output resolution** check box. This option aligns the output image to an integer multiple of the output resolution.

Error Fraction

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 – essentially 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 a quarter-pixel inaccuracy.

Block Value

Block values tell the encoder to reproject the pixels in blocks of dimensions the user may specify. (**Note:** These blocks are different from both the MG2 and the MG3/MG4 encoding blocks.) Using block values improves disk access and memory usage and can improve performance. Smaller block values use less memory but may be slower. Block values do not affect the output image.

By default the block value is 2048.

Resample Method

The **Resample Method** drop-down list shows the available resampling methods for the reprojection operation. Nearest Neighbor is the fastest method, while Bicubic gives more accurate results. Bilinear is a compromise – faster than Bicubic and more accurate than Nearest Neighbor.

Use Temp Files

If this check box is selected, the encoder caches the reprojection processing blocks to disk in the form of a temp file instead of keeping them in RAM.

By default this check box is selected.

Image Reprojection Scenarios

NOTE: The process of rendering previews for very large images or mosaics can be time consuming, especially when reprojecting mosaicked images in different resolutions and coordinate systems. Previewing does not decrement the data cartridge.

Single Image Reprojection Workflows

Reprojection of Single TIFF Images

A user has a set of 500 images in TIFF format with TIFF world files and wants to put each single image into a new coordinate system and encode to MrSID at the same time. The user adds the images into the Job list. GeoExpress knows where they are located (due to the world files) but knows nothing about the coordinate reference system (CRS). The user assigns a coordinate system to the source images to be used as a source CRS. The user can select multiple files and apply the CRS once to all of the source data. Then the user selects the destination CRS that will apply to all images in the current selection. The user specifies other compression parameters independent of the reprojection option, then encodes the images normally.

Reprojection of Single MG2 Images

Same as “Reprojection of Single TIFF Images” above, except that the user has MrSID Generation 2 images with sdw files.

Reprojection of MrSID Images with Embedded GeoTIFF

Same as “Reprojection of Single TIFF Images” above, except that the user has MrSID files with embedded GeoTIFF tags. GeoExpress automatically reads those GeoTIFF tags to determine the source coordinate system.

Reprojection of GeoTIFF Images

Same as “Reprojection of Single TIFF Images” above, except that the user has GeoTIFF files. GeoExpress automatically reads the CRS and assigns it as a source CRS.

Mosaic Reprojection Workflows

Mosaicking of Single Images All with Same CRS and Reprojection to New CRS

The user is a provider who has many GeoTIFF images in the same CRS (UTM). The user wants to mosaic these together and reproject them to the State Plane system. In this instance GeoExpress reads the CRS from the images and mosaic prior to reprojection to ensure a seamless mosaic.

Reprojection of UTM, State Plane and Lat-Long Together in a Single Mosaic

A city government has received images in UTM from the NAIP program, has existing imagery in state plane coordinate system and has purchased satellite imagery in lat-long. The imagery from NAIP is a one-foot-pixel, the city's imagery is a half-foot pixel and the satellite imagery is a five-meter pixel. The NAIP imagery is in MrSID format, the city's data is in GeoTIFF and the satellite imagery is in TIFF with TIFF world files. This user can create a single MrSID mosaic in State Plane coordinates from all three sources of imagery in one single encode operation.

Chapter 7: Job Options

Job Options Overview

Click **More Options** on the **Properties** tab to access options for a job. The job options depend on whether the selected job is a raster job or a mosaic job.

Raster Job Options

The following list describes some of the options that you can set for raster images and mosaics:

- Select an output destination.
- Select an output format and compression method.
- Select custom dimensions and resolution.
- Select tiling options.

*NOTE: For raster images, you can also click **Advanced** on the **Properties** tab to set additional options. For example, you can use the advanced options to select a color space, edit transparency values, and more. For more information on advanced job options, see Advanced Job Options on page 97.*

Destination Options

Use the **Destination** tab to save output files to a file on your machine or to an Express Server. You can only save MrSID, JPEG 2000, and NITF images to Express Server.

To select an output destination:

1. Select one or more jobs in the **Job List**.
2. Click **Properties** to view the **Properties** tab.
3. In the **Job Options** panel, enter a file path in the output destination field. Alternatively, to

select an Express Server, click **More Options** and select the **Publish to Express Server** check box.

Selecting an Output File

By default, the output directory is the same as the input directory.

To change the default output directory, see *Preferences* on page 159.

Selecting an Express Server

GeoExpress 9.5 supports Express Server version 6.0 and later. You can save images in the following output formats to an Express Server:

- MrSID Generation 4
- MrSID Generation 3
- MrSID Generation 2
- JPEG 2000 (Part I)
- JPEG 2000 (GMLJP2)
- NITF

If you select **Publish to Express Server** on the **Job Options** dialog, you must still specify a file path on the **Destination** tab. GeoExpress uses the directory that you specify as a temporary directory where it saves the output file before publishing to Express Server.

When you select **Express Server** as the output destination, the **Express Server Browser** opens.

1. In the **Express Server Browser**, enter the URL of the Express Server to which you want to save files. Alternatively, click the drop-down box to view the list of Express Servers to which you have recently connected.

   For example, you might enter the following URL:

   `express-server.lizardtech.com`

2. Click **Connect**.

   NOTE: The server is queried for a list of catalogs on the server. Catalogs that have a spatial index appear with the world map icon *and the EPSG code of*

> *the spatial index. If there are no catalogs on the Express Server, contact the server administrator.*

3. If the Express Server requires authentication, a dialog box prompts you for a user name and password. Enter the user name and password that you want to use and click **OK**.
4. Select the catalog to which you want to save your files.

   > *NOTE: The output images that you create must use the same spatial reference system as the target catalog.*

5. Optionally, select the **Replace existing files** check box to overwrite files in the catalog that have the same name.

   If files with the same name exist and the check box is not selected, the upload fails and reports that the file exists.

6. Click **OK**.

Format and Compression Options

Use the **Format and Compression** tab to select an output format and compression method.

For more information about output formats, see *Supported Output Formats* on page 30. For more information about compression, see *Compression Overview* on page 39.

Dimensions and Resolution Options

Use the **Dimensions and Resolution** tab to change the dimensions of an image or select a custom resolution.

You can select from the following dimensions:

- Full resolution. Use the native resolution of the input image. This option is the default.
- Print. Scale the image so that the resolution matches that of a typical printer.
- Medium. Scale the image to either 2048 pixels wide or 2048 pixels high depending on the orientation.
- Web. Scale the image to either 512 pixels wide or 512 pixels high depending on the orientation.
- Custom. Enter a custom width and height, or enter a custom resolution.

NOTE: GeoExpress will not attempt to increase the resolution of images. If you select a resolution greater than the full resolution of an image, GeoExpress creates an image at full resolution. For example, if the source image is 5000 pixels wide and you attempt to set the width to 8000 pixels, GeoExpress reverts to a width of 5000 pixels.

Tiling Options

Use the **Tiling** tab to break the output image into multiple tiles.

The following list describes the tiling options that you can select:

- No tiling. Create a single output image. This option is the default.
- Number of tiles. Break an image into a number of columns and rows that you specify. For example, if you select four columns and three rows, the job creates 12 images.
- Tile by units. Break an image into tiles based on the geospatial units of the image. For example, if the image is in a UTM projection, the unit is meters and you can create tiles 1000 meters wide by 1000 meters high.
- Tile by pixel area. Break an image into tiles such that each tile has the width and height that you specify. For example, you may want to create square tiles that are 2048 by 2048 pixels.

LiDAR Job Options

The following list describes some of the options that you can set for LiDAR images and mosaics:

- Enter a custom block size.
- Omit LAS variable length record (VLR) metadata.
- Column mapping options for text files.

LiDAR Compression Options

Use the **Compression** tab to change the block size and remove variable length record (VLR) metadata from LAS files.

The block size is the number of points that GeoExpress processes and stores 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.

If you select the **Omit Custom LAS VLR metadata** option, GeoExpress removes VLR metadata from LAS files. VLR metadata can include vendor-specific data, user-specified data, and more.

LiDAR Text Parsing Options

Use the **Text Parsing** tab of the **Job Options** dialog to map text file columns to standard or custom fields and to load the whole text file. GeoExpress prompts you to set these options automatically when you add a LiDAR text file. At a minimum, you must map the X, Y, and Z columns of a file.

Header Lines

LAS files often contain header lines with the names of the columns and additional information. Enter the number of header lines are in the file so that GeoExpress does not attempt to read those lines as valid values.

Column Mapping

Use the drop-down boxes for each column to map values to standard fields like X, Y, Z, Intensity, and more.

Custom Fields

Create, edit, and delete custom fields that you want to map to columns. For example, you may want to create fields for a custom GPS time format or for sensor information.

Precision Factors

When a job is run, each number in the data columns is represented by an offset and the default precision factor of .001. The Precision factor fields enable you to change the factor by which the data in any or all three axis columns will be represented to account for the number of significant decimal places in those columns.

Reading the Whole File

If you select this option, GeoExpress reads the whole text file to determine image properties like the extents. You must select this option if you want to preview the LiDAR point cloud.

Column Mapping Prompt

Select the **Prompt me to map columns every time** option to display these text parsing options every time that a text file is added.

Chapter 8: Advanced Job Options

Advanced Job Options Overview

For raster images, you can click the **Advanced** button on the **Properties** tab to select additional job options.

The following table describes some of the tasks that you can perform in each tab of the **Advanced Job Options** dialog box.

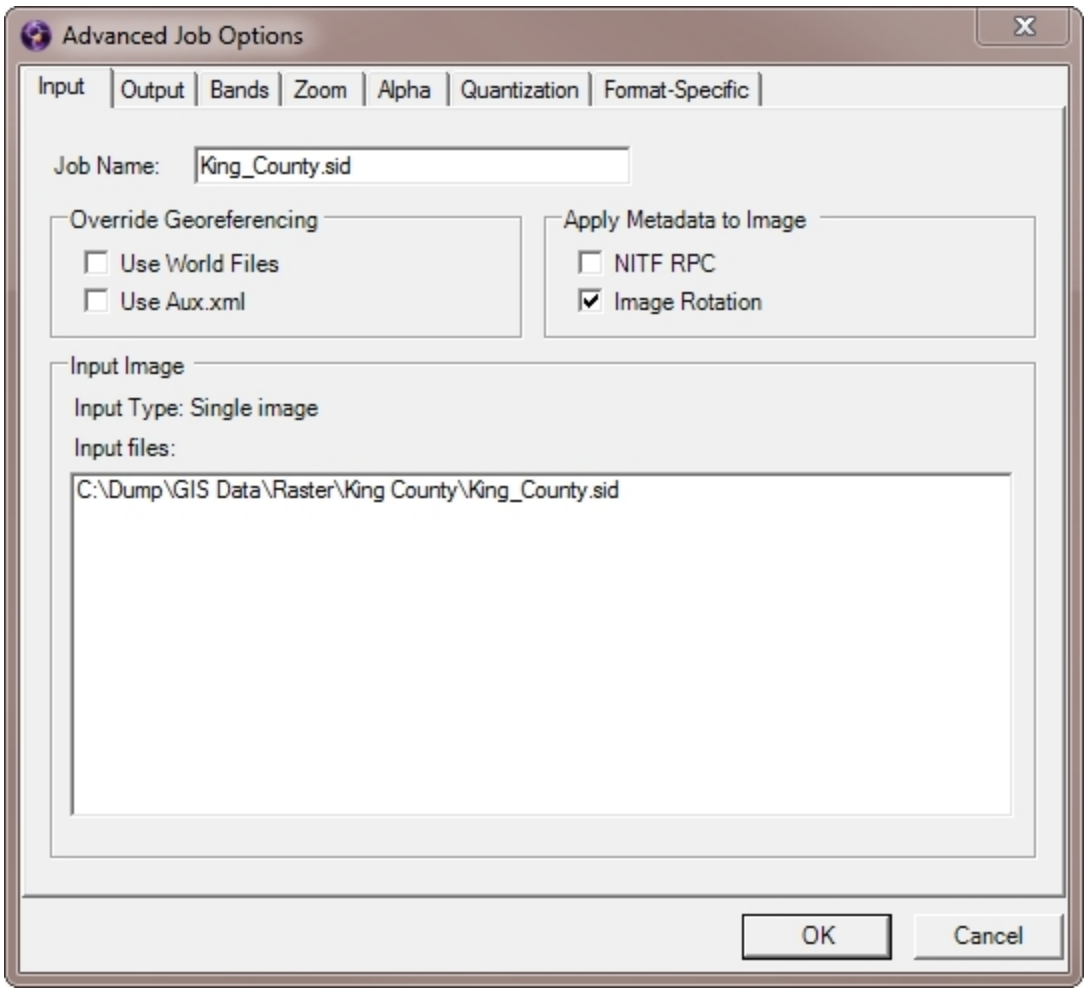
Tab	Tasks
Input	Change the name of the selected job. Use world files and aux.xml files to override the georeferencing information in the selected image. Apply image rotation from the image metadata. Apply NITF RPC from the metadata.
Output	Create a test output image. Convert images to 8-bit images. Set a custom watermark for the selected image. Crop a DOQ image with corner cross points. Flatten a composite mosaic. Enable multiresolution mosaics. Enable mosaics with multiple coordinate reference systems.

Tab	Tasks
	Enable multiple image segments for NITF images.
Bands	Select a color space for an image. Select and map bands for an image.
Zoom	Set the number of zoom levels in the output image. Specify a target thumbnail size. Resample an image.
Alpha	Specify transparency values for MrSID Generation 4 (MG4) files. Create or regenerate an alpha band.
Transparency	Specify transparency values for JPEG 2000 files, MrSID Generation 2 (MG2) files, and MrSID Generation 3 (MG3) files.
Quantization	Enter quantization options for floating point images. Quantization is the compression method for floating point images.
Security	Set password protection for MG2 and MG3 images.
Format-Specific	Configure image encoding performance by changing the block size or strip height. Configure the display of an image by changing the weight values and sharpness. Generate dynamic range metadata. Select and edit JPEG 2000 profiles. For more information, see *Format-Specific Options Overview* on page 121.

*NOTE: The options that you can see in the **Advanced Job Options** dialog box depend on the output format that you select.*

Input Options

The **Input** tab contains four panels: the **Job Name** panel, the **Override Georeferencing** panel, the **Apply Metadata to Image** panel, and the **Input Image** panel.



Use the **Job Name** panel to change the name displayed in the **Job List**.

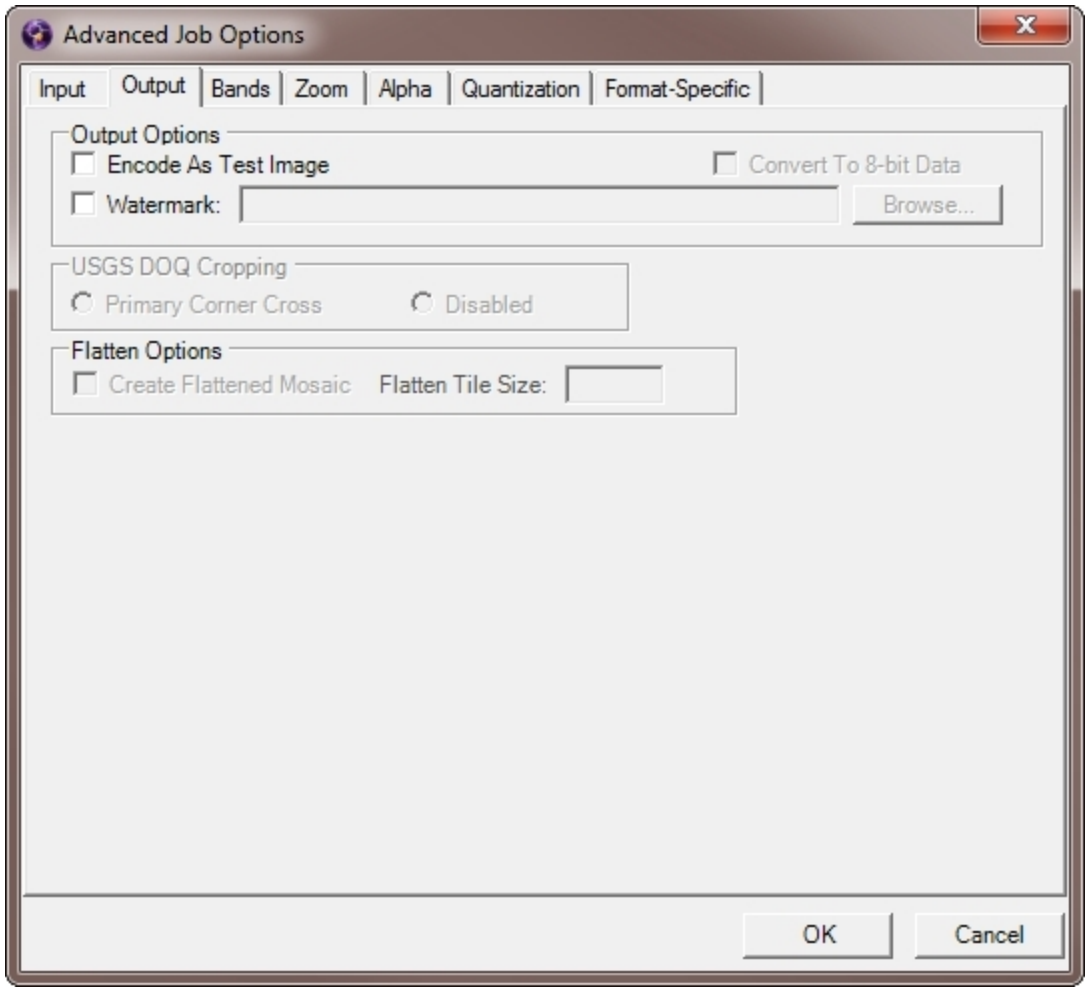
Use the **Override Georeferencing** panel to override a file's native georeferencing information with information from another file. The other file can be a world file or an aux.xml file included in the same directory as the image. When georeferencing information for an image or mosaic tile is given in the form of a world file or aux.xml file, GeoExpress can use that information to override the file's native georeferencing. For more information on world files, see *World Files* on page 182.

Use the **Apply Metadata to Image** panel to change the output image based on information in the image metadata. There are two types of metadata that you can apply: NITF RPC metadata and image rotation metadata. NITF RPC metadata maps pixel data to location data for orthorectification. Image rotation metadata describes how to rotate the output image.

The **Input Image** panel identifies whether the input image is a single image, a mosaic, or a color composite image, and lists the input file or files. Note that the job name can be different from the input file name and the output file name. Also the job name is different from the project name that is displayed in the blue bar at the top of the screen in the work area.

Output Options

Set options for the output image in the **Output** tab. The options that you see depend on the job type and the output format.



You can specify the following options:

Test Image Option

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 images and mosaics as test images, but not LiDAR point clouds.

8-Bit Data Option

Converting unsigned 16-bit data to unsigned 8-bit data during encoding.

Watermark Option

You can add custom watermarks to your images. GeoExpress supports watermark images in BMP, PNG, and JPEG formats. You can use black and white images with maximum dimensions of 128 pixels by 128 pixels.

Click the **Browse** button to select the image that you want to use as a watermark. The following figure shows an example of a watermarked image:

USGS DOQ Cropping Option

If the job contains DOQ images, the **USGS DOQ Cropping** panel will be available. Cropping is either by corner cross or disabled.

Flatten Option

To flatten a composite mosaic, select the **Create Flattened Mosaic** option. When you flatten a mosaic that contains overlapping tiles, you discard the data from tiles that are not visible. For more information on composite mosaics, see *Mosaic Output Formats* on page 144.

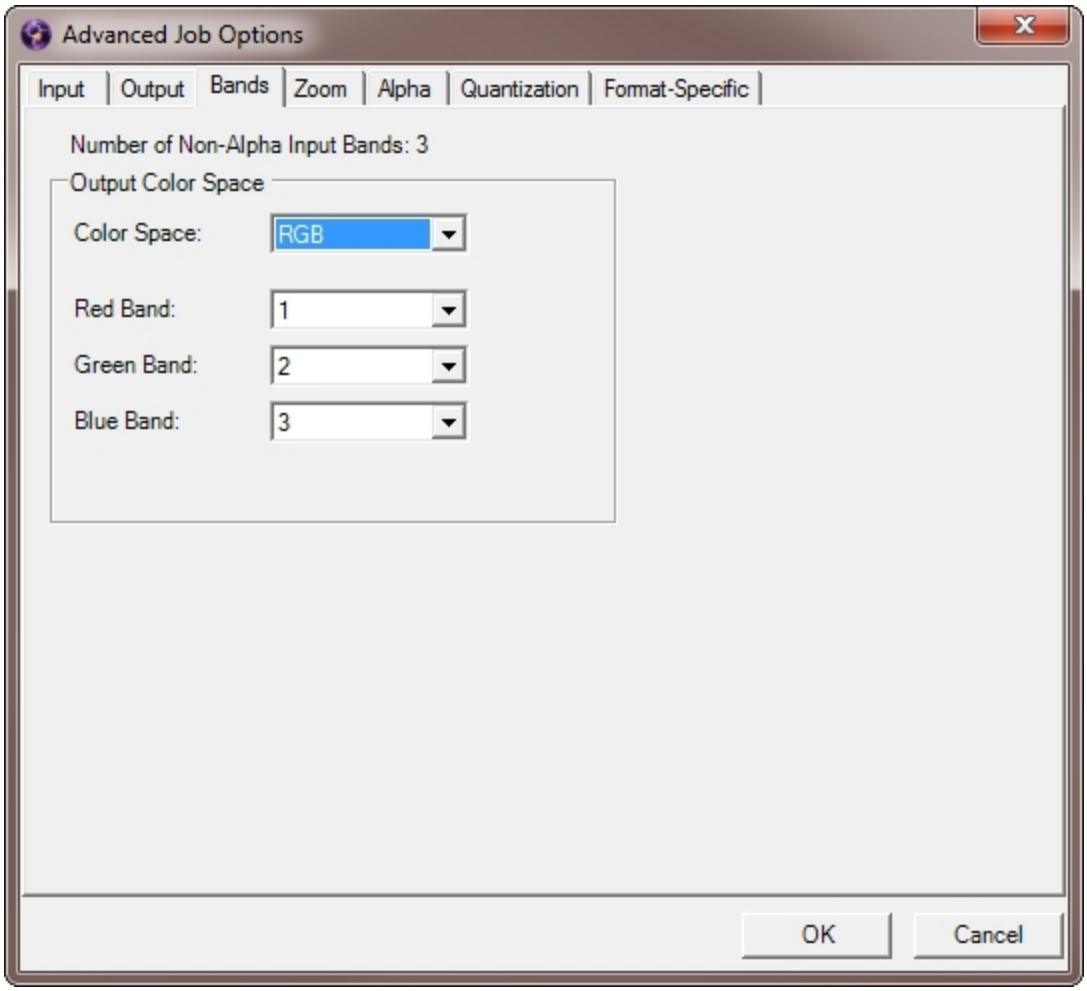
When you flatten a mosaic, the **Flatten Tile Size** field is available. GeoExpress divides mosaics that are to be flattened into tiles for encoding. Acceptable values are integers between 1024 and 4096, and powers of two (1024, 2048 and 4096) are recommended though not required. The default tile size is 4096.

NOTE: You may encounter irregularities in the progress meter when flattening mosaics.

Band Options

Use the **Bands** tab to select a color space for the output image and to select and map bands.

NOTE: For MG3 files, the output color space is only supported for encoding single images and flat image mosaics.



Output Color Space

The options available in this group depend on which color space is selected in the drop-down menu. For grayscale or RGB output, another drop-down menu enables you to select a single band or three bands, respectively. For multispectral output, the **Select Bands** button appears enabling

you to access a dialog where you can select bands from your input image and order them for your output image. The default color space is **Same as source**. For more information on selecting bands, see *Selecting and Mapping Bands* on page 105.

The MrSID Generation 4 (MG4) format supports multispectral color spaces, but in order for MG3 to accommodate multispectral input files, an output color space (or target color space) and band orientation must be specified. MG2 does not support the multispectral color space.

For multispectral images, select the **Apply RGB Color Transform to First Three Bands** check box if the first three bands in your output list are Red, Green and Blue, in that order. If the first three bands are not Red, Green, and Blue, click the **Select Bands** button to re-order the bands. For more information on the RGB color transform, see *The RGB Color Transform* on page 42.

Supported Output Color Spaces

The following table shows supported output MrSID color spaces for various input and output formats:

Supported Color Spaces

Color Space of Source Image	Supported MrSID Output	Supported JPEG 2000 Output
Grayscale	Grayscale	Grayscale
RGB	RGB, Grayscale	RGB, Grayscale
CMYK	CMYK, Grayscale	*Not Supported*
Multispectral	RGB, Grayscale, CMYK, Multispectral	RGB, Grayscale, Multispectral

For multibanded output to MG4 and JPEG 2000, additional options on the **Color Space** drop-down are available, most notably that a multispectral input image can use **Same as source** for the output color space.

NOTE: GeoExpress 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.

With multispectral image support, it becomes necessary to provide color space control over the input and output images so that they can be viewed by human eyes. The **Output Color Space** control shows a list of supported output color spaces for the currently selected output format. The supported output color spaces for MrSID Generation 3 (MG3) are grayscale, RGB, and CMYK. If the input image is already in one of the supported color spaces, **Same as source** will also be an available option. By selecting an output color space other than **Same as source**, a group of band selectors will become visible, allowing the user to choose which input bands map to the output color space. If you chose **RGB** as your output color space, three controls would appear for choosing the red, green, and blue component bands of the output image. Then you could choose which bands of the source image were most interesting or important to you, for example bands 1, 3, and 5.

If you want to encode a six-banded image to MrSID format, you should select MG4 as your output format.

Selecting and Mapping Bands

For raster multispectral images, you can select and map image bands from a source image to a MrSID or JPEG 2000 output image. Not all workflows are available for all output formats.

The following table shows which workflows each format supports.

Support for Band Selection and Mapping in GeoExpress Output File Formats

Workflow:	Supported by Output File Format:			
	MG2	MG3	MG4	JPEG 2000
Choose one band from an RGB or multispectral source image to represent the single output ("grayscale") band	♦	♦	♦	♦
Map any three bands from an RGB or multispectral source image to the red (R), green (G) and blue (B) output bands	♦	♦	♦	♦
Choose to carry all source bands over to your output image in their original order			♦	♦
Map an arbitrary subset of bands (more than 3) from a multispectral image to your output image in any order			♦	

By default, GeoExpress retains all source bands in order.

The following procedures assume you have loaded one or more images into the **Job List**.

Selecting a Grayscale Band

You can select a single band for MrSID or JPEG 2000 output.

1. Select a MrSID or JPEG 2000 format from the **Output Format** drop-down menu.
2. Click the **Advanced** button in the **Properties** tab.

   The **Advanced Job Options** dialog box appears.
3. Select the **Bands** tab.
4. From the **Color Space** drop-down menu choose **Grayscale**.

   A drop-down menu appears listing all the available bands in the source image.
5. Choose any single band from the drop-down menu.
6. Set other options on this tab or click **OK**.

Selecting Bands for RGB Output

You can select and map bands for RGB output in MG3, MG4, or JPEG 2000 format.

1. Select a MrSID or JPEG 2000 format from the **Output Format** drop-down menu.
2. Click the **Advanced** button in the **Properties** tab.

   The **Advanced Job Options** dialog box appears.
3. Select the **Bands** tab.
4. From the **Color Space** drop-down menu choose **RGB**. Several drop-down menus appear listing all the available bands in the source image.
5. Choose any three bands from the drop-down menus.
6. Click **OK**.

Retaining All Source Bands in Order

You can carry over all source bands to MG4 or JPEG 2000 output formats in their original order.

1. Select MrSID Generation 4 or JPEG 2000 from the **Output Format** drop-down menu.
2. Click the **Advanced** button in the **Properties** tab.

   The **Advanced Job Options** dialog box appears.
3. Select the **Bands** tab.
4. From the **Color Space** drop-down menu choose **Same as source**.
5. Set other options on this tab or click **OK**.

Selecting and Mapping Bands for Multispectral Output

You can select and map more than three bands for MG4 output.

1. Select **MrSID Generation 4** from the **Output Format** drop-down menu.
2. Click the **Advanced** button in the **Properties** tab.

   The **Advanced Job Options** dialog box appears.
3. Select the **Bands** tab.
4. From the **Color Space** drop-down menu choose **Multispectral**, then click **Select Bands**.

   The **Select Bands** dialog box appears. By default, all bands are carried over from the input list to the output list.

   > *NOTE: The Alpha band is encoded losslessly and is not displayed in the list of bands. For more information on Alpha bands in MrSID images, see Alpha Options on page 111. For more information about Alpha bands in JPEG 2000 imagery, see Encoding with Alpha Bands in JPEG 2000 on page 187.*
5. If the image contains red, green, and blue (RGB) bands, re-order the bands with the up and down arrows so that these bands are at the top of the bands list, then select the option to **Apply RGB Color Transform to First Three Bands**.

   > *IMPORTANT: When you set the first three bands of the image as the RGB bands and apply the RGB Color Transform, GeoExpress optimizes the image compression ratio of each one of the RGB bands to create a smaller image without sacrificing visual quality.*

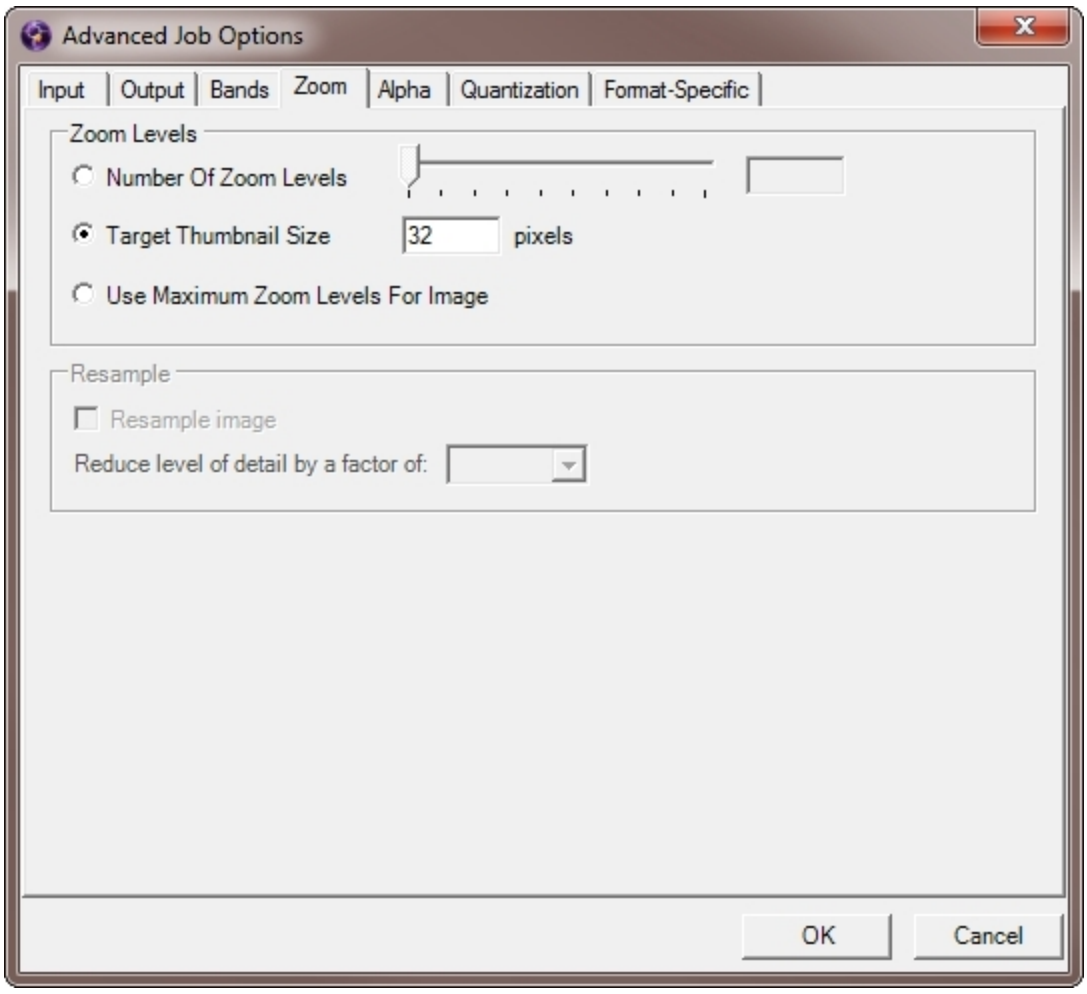
For more information on the RGB color transform, see The RGB Color Transform on page 42.

6. Optionally, select the bands that you want to remove from the output image and click the left arrow to remove them.
7. Click **OK**.

NOTE: For information on setting per-band compression ratios, see Specifying Per-Band Compression Ratios on page 41.

Zoom Options

Use the **Zoom** tab to select the number of zoom levels that you want in the output image or to specify a target thumbnail size. For an MG3 or MG4 file you can also resample the image.



The number of zoom levels in an encoded image can be specified directly or it can be dependent on the image size in relation to a specified target thumbnail size. The larger the image, the greater the number of zoom levels it can contain.

By default, GeoExpress does not specify the number of zoom levels but uses a thumbnail size of 32 pixels instead. You may specify a higher value here, resulting in fewer zoom levels, or a lower value, resulting in more. Alternatively you may specify a number of zoom levels or instruct the program to use the maximum number of zoom levels the image can contain.

To specify the number of zoom levels, select the **Number of Zoom Levels** radio button and drag the slider or enter the number of levels in the **Zoom Level** field.

Zoom level can be set to any value greater than zero for MG3 and MG4 and from three through nine levels for MG2.

NOTE: The full resolution (or base) image is called the zeroth level (0th 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.

To specify the target thumbnail size, select the **Target Thumbnail Size** radio button and enter a dimension in pixels.

To allow GeoExpress to automatically calculate and use the maximum number of zoom levels possible for an image, select the **Use Maximum Zoom Levels for Image** radio button. This option is selected by default.

Resampling an Image

Resample an image to reduce the number of zoom levels in an MG3 or MG4 image. You might resample an image for placement in an online catalog where you know it will only be displayed at a certain maximum size.

The resampling operation copies zoom levels from an existing image to make a new image. As a result, you can only resample images that meet the following criteria:

- The image must be in the MG3 or MG4 format.
- The output format for the image must be the same as the input format. For example, for an MG3 input image, you can only create a resampled MG3 output image.
- The image must have been created as an optimizable image. By default, MG3 and MG4 images are optimizable.
- The resampling operation cannot be combined with other image manipulation operations that require decoding the image data. For example, you cannot perform reprojection or color balancing operations in the same job as a resampling operation. Instead, resample the image, run the job, and then perform additional operations on the new image.

To resample an image, complete the following steps:

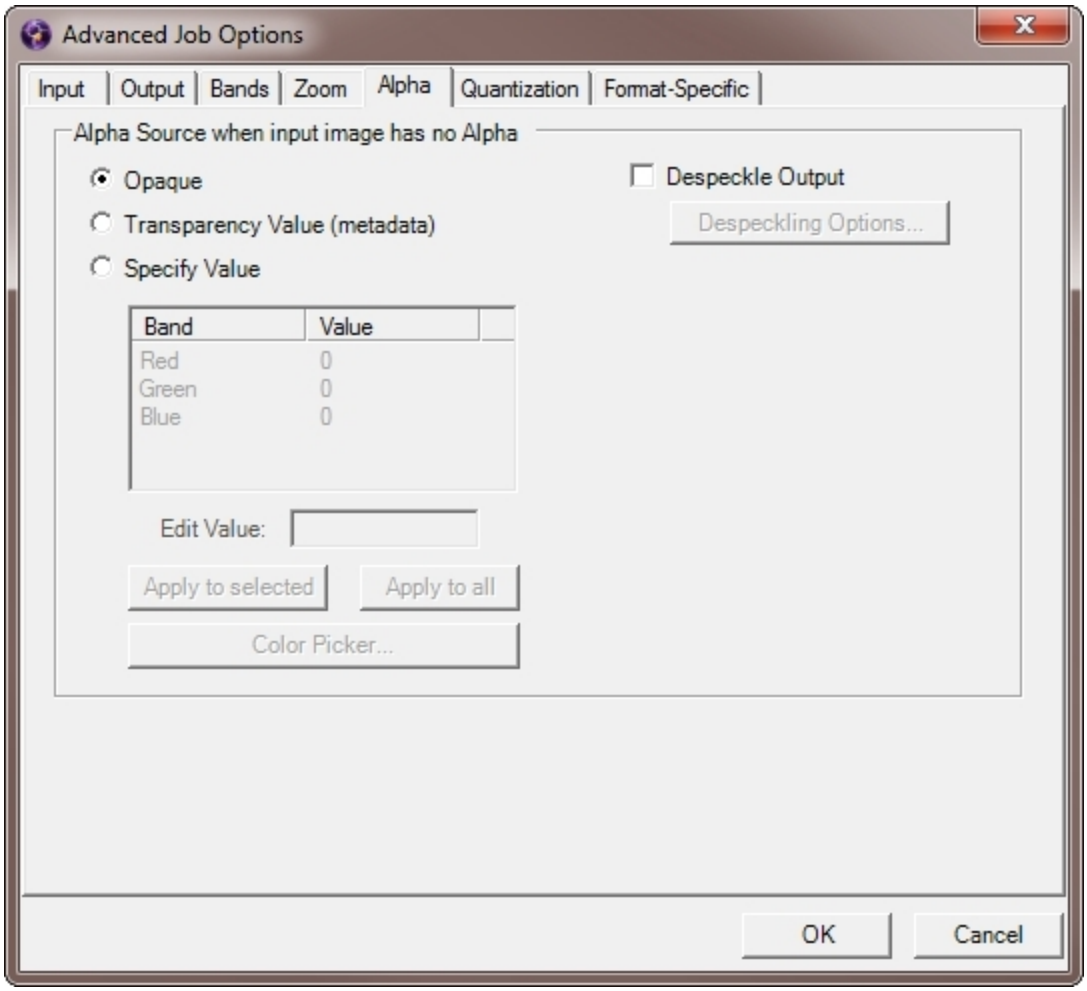
1. Click **Advanced** in the **Properties** tab.
2. Click the **Zoom** tab.
3. Select the **Resample image** option and select the factor by which you want to reduce the level of detail.

Resampling by a factor of two removes one zoom level and halves the image's width and height so that the result has a fourth of the area of the original. Resampling by a factor of four removes two zoom levels and quarters the image's width and height so that the result has one sixteenth of the area of the original. The number of resampling factors available in the drop-down menu is determined by the size of the original image.

Alpha Options

When you select MG4 as the image output format, you can use the **Alpha** tab to create or regenerate alpha bands. In MG4 images, the alpha band records which portions of your image do not contain image data.

For MG2, MG3, and JPEG 2000 files you can specify no-data values in the **Transparency** tab.



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.

> *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.*

Creating an Alpha Band

All images encoded to MrSID Generation 4 have an alpha band.

1. Click **Advanced** in the **Properties** tab.
2. Click the **Alpha** tab.
3. Select the method that you want to use to create an alpha band.

   You can select one of the following methods:

   - **Opaque**. The Opaque method specifies that all pixels should be treated as valid image data. By default the Opaque method is selected.
   - **Automatically Detect**. In the Automatically Detect method, GeoExpress queries the image metadata for the transparency values and treats all pixels with matching band color values as transparent.
   - **Specify Value**. You may specify transparency values for each band. GeoExpress treats as transparent all pixels whose band color values match the specified values. If you decide to specify a value for each band, you can use the color picker.

If your source image already has an alpha band, a **Regenerate Alpha Band** check box appears at the bottom of this tab so that you can discard the existing alpha band. By default, GeoExpress

uses and preserves a source image's alpha band. This option might be used if your alpha band is corrupted or incorrect, in which case GeoExpress creates a new one.

Skip to *Specifying a Compression Method* on page 32.

Despeckling Output

Speckling is an artifact of lossy compression that causes pixels which should be transparent to display in the output.

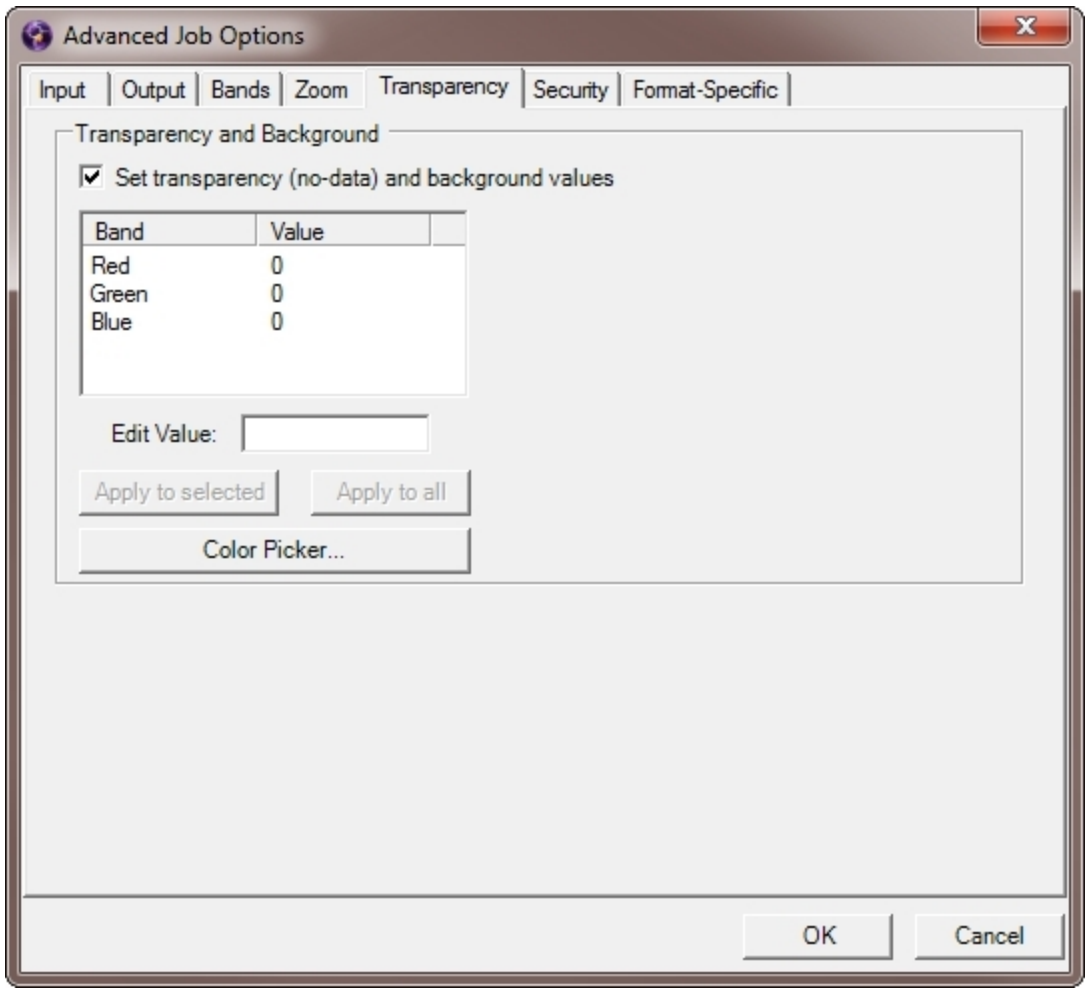
For example, you may specify 0,0,0 as the alpha band values for an RGB image so that all of the black pixels are made transparent. But in compression, the values of some pixels undergo slight changes in value. The difference is not be visible to the eye, but a pixel whose RGB values are 0,1,0 or 0,0,1, while it may still look black, no longer matches the specified transparency profile and so it will not be rendered transparent. Where this happens, speckling can appear in the collar regions of an image such as a DOQQ. In this case, select the **Despeckle Output** check box to ensure that all of the pixels that should be transparent are treated correctly.

For more information and to manually set despeckling options, see *The Despeckle Tool* on page 61.

Transparency Options

When you select MG2, MG3, or JPEG 2000 as the image output format, you can use the options on the **Transparency** tab to define the color of transparency and background areas. One color must serve for both the transparency and background values.

You can specify colors based on the color space (RGB/grayscale) and color depth (8-bit/16-bit) of the source image.



Transparency and Background Color

The transparency and background color setting must be within the range of pixel values that the image's data type supports (e.g. 0 – 255 for 8-bit images and 0 – 65,535 for 16-bit images). These values are derived from the native metadata for an input image.

To select an alternate transparency and background color do one of the following:

- Enter RGB values for each band using the Edit Value field. Values can be assigned to single or multiple bands.
- Select a color using the **Color Picker**.

The effects of the transparency options can be simulated in the **Preview** tab.

NOTE: The MG4 format stores transparency in an alpha band whereas MG3, MG2, and JPEG 2000 images map transparency to a specific color. If your input image is in the MG4 format, and if the output format is MG3, MG2, or JPEG 2000, transparency is mapped to the transparency color that you specify.

Color Picker

You can select an 8-bit RGB color value from the color palette or **Color Picker** if the source image is an 8-bit RGB.

1. Click **Color Picker**. The **Color** dialog box appears with 48 color options displayed, including black and white. If desired, custom colors can be added to the existing basic colors palette.
2. Select the proper color from the displayed palette.
3. Click **OK**.

GeoExpress uses the standard Windows color picker interface, which allows you to add custom colors. See your Microsoft Windows or Microsoft Office documentation for more information about picking colors.

Specifying a Transparency Value in Indexed Color Images

All images in the MrSID format are in either grayscale or RGB mode. Color images are RGB; black-and-white images are grayscale. Any black-and-white image encoded by GeoExpress, if not already in grayscale mode, is converted to grayscale; any color image, if not already RGB (for instance, an indexed color image), is converted to RGB.

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 have been determined, they must be entered manually.

The RGB color scale for an 8-bit image, with values of 0-255 for the colors red, green, and blue, is capable of accurately displaying 16,777,216 colors. An indexed color image selects colors from a scale containing 256 colors. Each color in an indexed color image is specified using a value from 0 to 255.

Due to the wide variety of indexed-color valuing systems available, a specific color in one indexed color image can be given one value, while the same color in another image is given a different value. For example, a color with a single RGB value may be given an indexed color value of 120 by one imaging application and 142 by another.

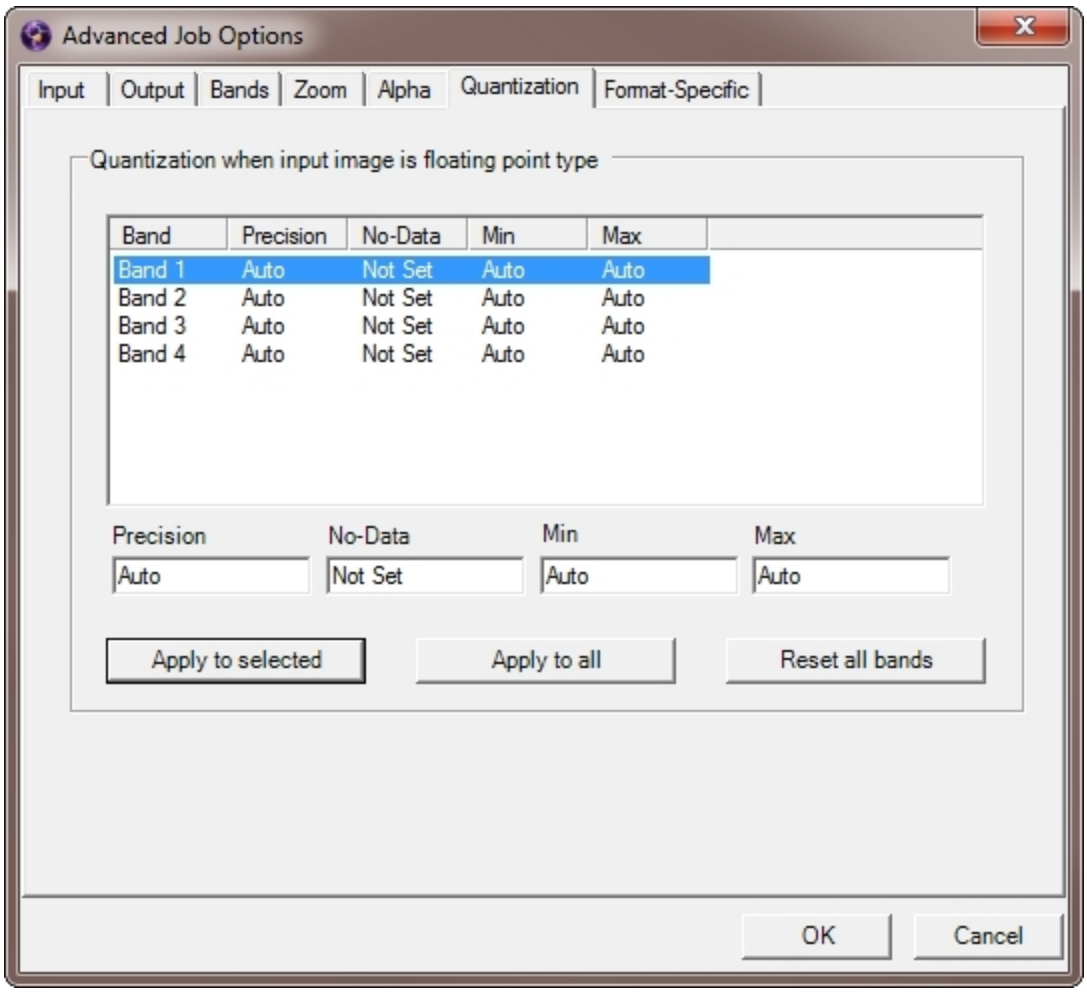
For this reason, any time the input or output transparency options are used with indexed color images, the indexed color values must be read in as RGB and entered manually.

If desired, use a color-finder program to read the transparency RGB values.

Quantization Options

When you select MG4 as the output format for a floating point image, you can use the options on the **Quantization** tab to define a quantization precision value and other quantization options.

For more information on quantization, see *Using Quantization for Floating Point* on page 43.



Quantization Precision

When you compress a floating point image, GeoExpress automatically calculates the optimized precision value to use for quantization. Alternatively, you can 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:

$$\text{Precision} = (\text{Maximum value} - \text{Minimum value}) / 2^{16}$$

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: Open the output image in GeoExpress to view the image metadata. For more information, see Viewing Metadata on page 48.*

Setting a Precision Value

To set a precision value, enter a value in the Precision field of the **Quantization** tab. 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.

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, enter minimum and maximum values on the **Quantization** tab. 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.

Quantization and No-Data

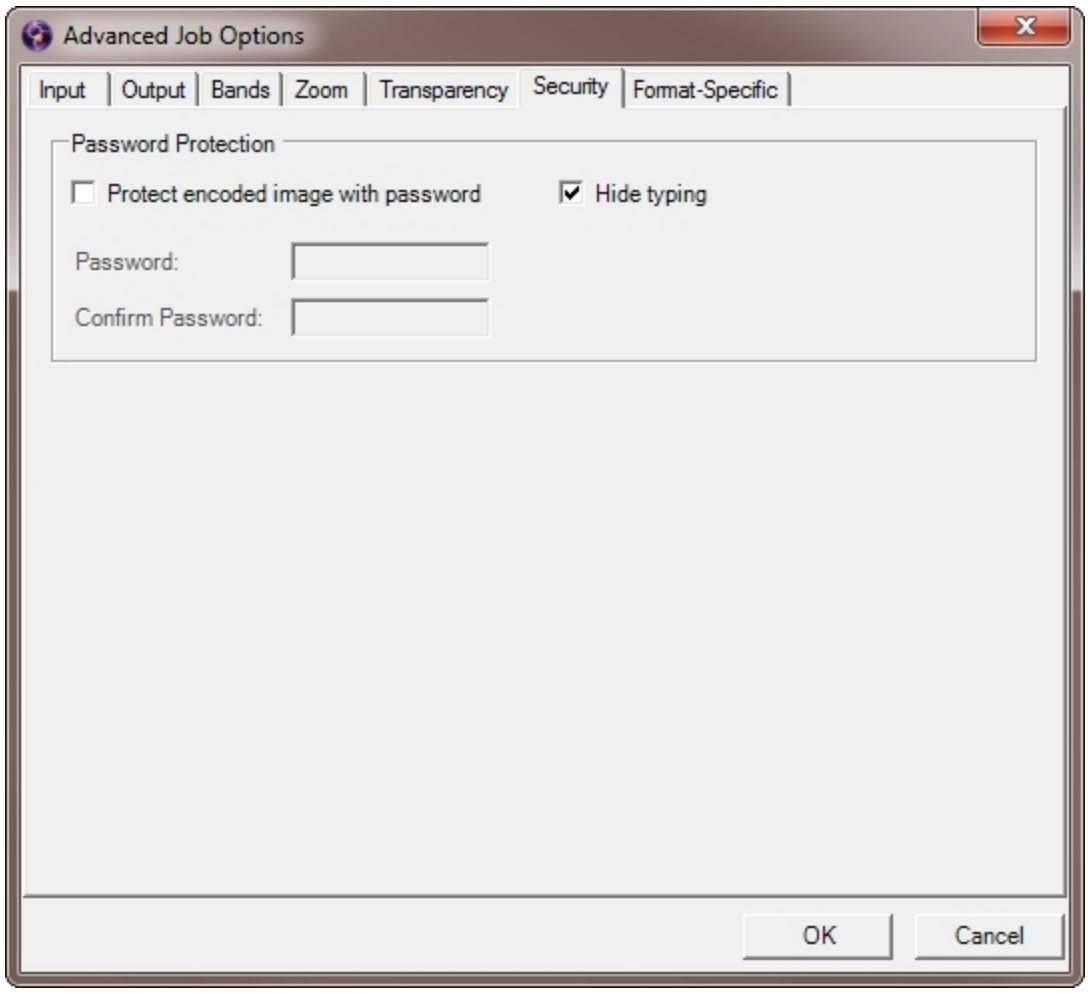
Many floating point images denote no-data values as an arbitrary minimum value. For example, an image may use -9999 as the no-data value even though there aren't any pixel values between -

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 *Dynamic Range Metadata Generation* on page 125. 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 in the **No-Data** field of the **Quantization** tab.

Security Options

GeoExpress enables you to lock your encoded MG2 and MG3 files with a password. MG4 does not support security options. You can access password-protected files with the ExpressView Browser Plug-in, which is included on your GeoExpress DVD and is optionally installed when you install GeoExpress.



The **Security** tab includes a **Protect encoded image with a password** check box. If this check box is selected you can then choose whether or not to hide the password typing with the **Hide typing** check box.

Notes

There is no way to access a password-protected file if you forget the password.

The password file is kept in the project file and stays with the project. Although a useful data protection feature, this is not a fully robust file security solution.

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.

Chapter 9: Format-Specific Options

Format-Specific Options Overview

To perform tasks specific to the MrSID and JPEG 2000 file formats, configure options on the **Format-Specific** tab of the **Advanced Job Options** dialog box.

Use these advanced format-specific options to perform the following tasks:

- Configure performance by changing the block size or strip height.
- Configure the display of an image by changing the weight values and sharpness.
- Generate dynamic range metadata for MrSID Generation 4 output images.
- Select and edit JPEG 2000 profiles.

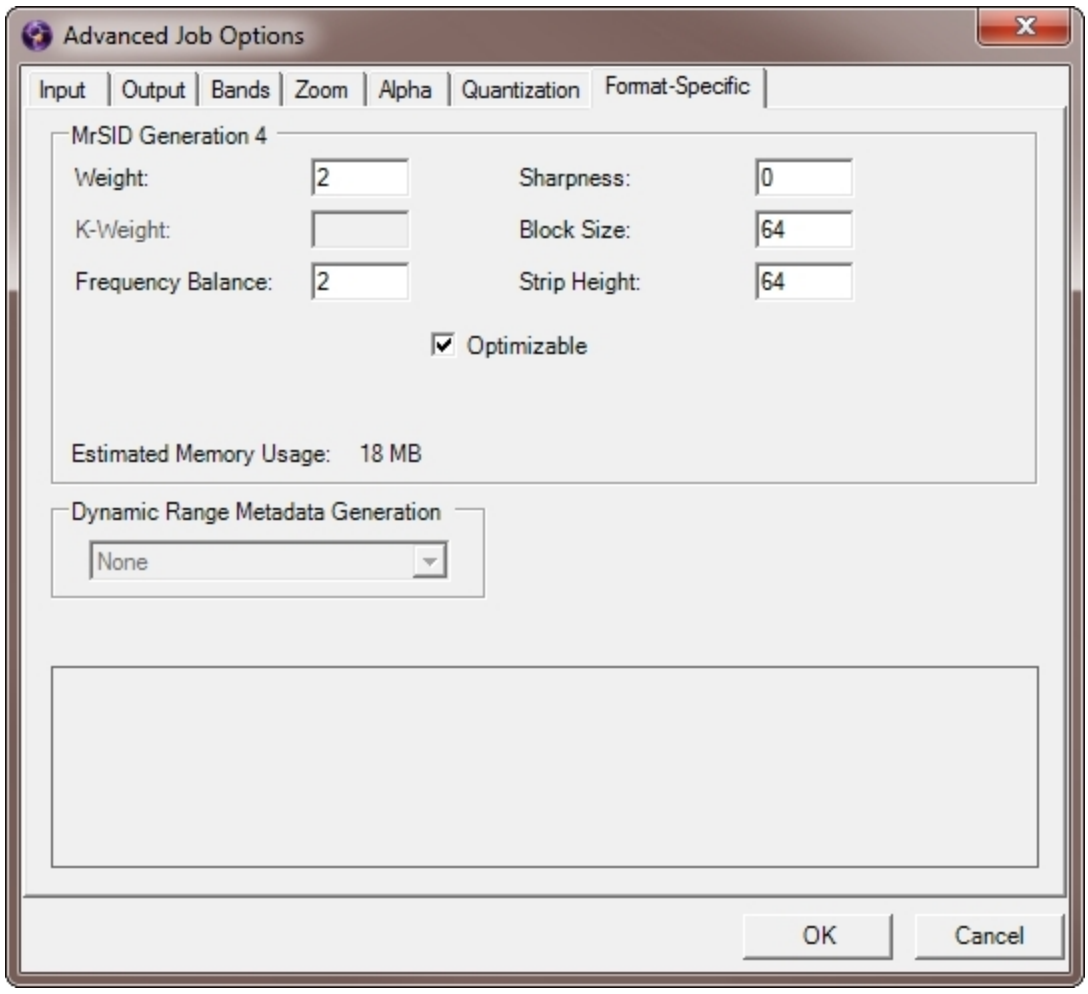
For MrSID images, you can select different options for MrSID Generation 4, MrSID Generation 3, and MrSID Generation 2 files.

> *NOTE: The options that you can see depend on the output format that you select.*

Advanced MG4 Options

You can use the options for the MG4 output format to configure the display of an image, configure performance, and generate dynamic range metadata.

The following figure displays the options that you can select for the MG4 output format:



Weight

Weight affects the grayscale portion of a color image, which is the part of the image with no color information. A higher weight setting increases the emphasis on this grayscale aspect of a color image, while decreasing emphasis on color quality. A lower setting increases the consistency of color between the MrSID image and the original data.

Images with high color contrast will benefit from a lower weight setting. Images with greater detail benefit from a higher weight setting.

Acceptable values: 0.0 - 10.0

Default: 2

K-Weight

Determines the emphasis for the K band of a CMYK color image. CMYK imagery with high color contrast will benefit from a lower setting. A CMYK image with a high density of detail will benefit from a higher setting. The practical range of values is 0.0 to 10 where 0.0 represents minimum intensity (and maximum color consistency between the MrSID image and the original CMYK data) and 10 represents maximum intensity.

Acceptable values: 0.0 - 10.0

Default: 0.25

Frequency Balance

Determines the emphasis given to edges and flat areas in color and grayscale images. Images requiring precise edge definition will benefit from a lower setting. If precise edges are not as important as consistency in flat color areas, increase this setting. The practical range of values is 0.1 to 10 where 0.1 represents maximum edge definition with less emphasis on flat areas, and 10 represents minimum edge definition with smoother areas of relatively consistent color.

Acceptable values: 0.0 - 10.0

Default: 2

Sharpness

Determines the sharpness of boundaries between different areas of an image. Images with large amounts of textured area (where color or intensity changes are occurring throughout a region, rather than just at a boundary) will benefit from a lower setting. Use a higher setting for images with little textured areas. The range of values is 0.0 to 1.0 where 0.0 represents minimum sharpness and 1.0 represents maximum sharpness.

Acceptable values: 0.0 - 1.0

Default: 0.0

Block Size

GeoExpress accesses image data in 'blocks' of pixels.

IMPORTANT: Blocks in MG3 and MG4 encoding are different from blocks in MG2 encoding. The block size parameter in MG3 controls how large the bitplane-encoded regions are. Lowering this parameter may lower the memory usage of the encoder but may also decrease the lossless compression ratio. Raising this parameter may increase memory usage, but may improve the lossless compression ratio. This parameter has little effect on overall encode time. Typical values range from 32 to 64.

Acceptable values: 5 - 64

Default: 64

Strip Height

Strip height affects performance and memory usage. The strip height parameter controls how many rows of the input image are processed at one time. Lowering this parameter may reduce memory usage, but may increase the encoding time. Raising this parameter may increase memory usage, but may also decrease encoding time. Unlike the block size, changing this parameter will not have any effect on the compression ratio of the output image.

Typical values range from 2 to 128. The encoder may perform more efficiently if the block size is a multiple of the strip height.

Acceptable values: even integers between 2 and source image height

Default: 64

Optimizable

Determines whether the output MrSID file contains optimization data. By default the **Optimizable** check box is selected.

The option for optimizing images is specific to MG3 and MG4 files. When you optimize an image, you make it possible to perform some image manipulation operations on the image without re-encoding or recompressing the image. Image manipulation operations that benefit from optimization include the following:

- Resampling
- Cropping

- Demosaicking
- Area of interest encoding

Creating an optimized image does not affect encoding time. However, saving optimization data for an image modestly increases the size of an image by approximately one to five percent. If image size is critical and you do not plan to perform further image manipulation operations, deselect the **Optimizable** option.

Use a Temporary File

Select the **Use Temp File** option to allow GeoExpress to create temporary files during image encoding. To specify the default directory for temporary files, see *Preferences* on page 159.

Dynamic Range Metadata Generation

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

You can generate dynamic range metadata for all images with the exception of eight bit 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.

Dynamic Range Generation Methods

To calculate the dynamic range of an image, select a dynamic range generation method.

You can select 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.

Merged

Calculate the minimum and maximum dynamic range values for an image with multiple bands. Select the **Merged** 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 **Merged** 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.

None

Do not calculate the dynamic range of the image.

*NOTE: To enter the minimum and maximum dynamic range values manually, select **None** as the dynamic range generation method and edit the image metadata. For more information on entering dynamic range metadata manually, see Image Metadata on page 48.*

Automatic and Strict Dynamic Range

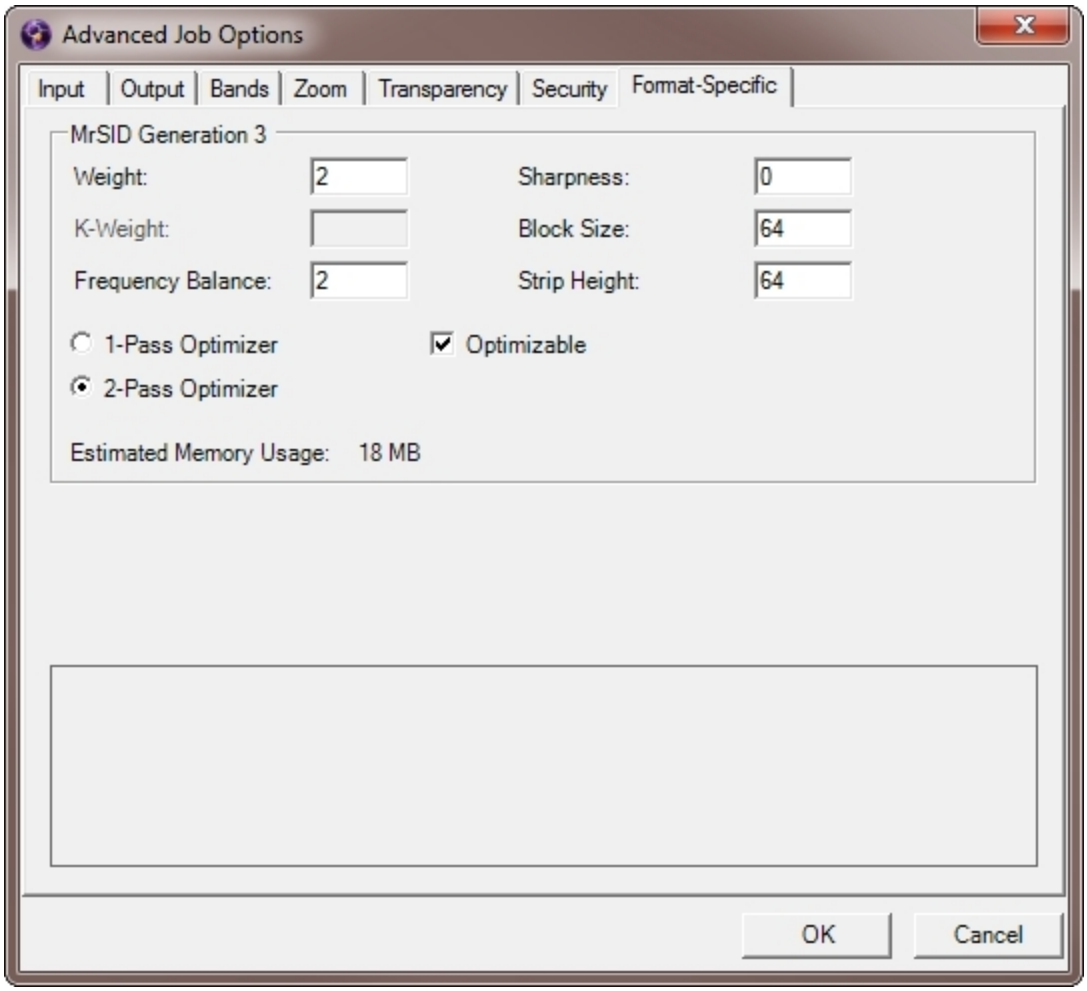
For 16-bit images with unsigned integer data, you can select either **Automatic Range** or **Strict Range**. 16-bit images with signed integer data and all 32-bit images use the **Strict Range** option. The following list describes the two ranges that you can select:

- **Automatic Range**. Set the maximum value to the estimated bit-depth and set the minimum 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.
- **Strict Range**. Set the maximum and minimum values to the exact dynamic range values calculated by GeoExpress.

Advanced MG3 Options

You can use the options for the MG3 output format to configure the display of an image, configure performance, and set optimization options.

The following figure displays the options that you can select for the MG3 output format:



Weight

Weight affects the grayscale portion of a color image, which is the part of the image with no color information. A higher weight setting increases the emphasis on this grayscale aspect of a color image, while decreasing emphasis on color quality. A lower setting increases the consistency of color between the MrSID image and the original data.

Images with high color contrast will benefit from a lower weight setting. Images with greater detail benefit from a higher weight setting.

Acceptable values: 0.0 - 10.0

Default: 2

K-Weight

Determines the emphasis for the K band of a CMYK color image. CMYK imagery with high color contrast will benefit from a lower setting. A CMYK image with a high density of detail will benefit from a higher setting. The practical range of values is 0.0 to 10 where 0.0 represents minimum intensity (and maximum color consistency between the MrSID image and the original CMYK data) and 10 represents maximum intensity.

Acceptable values: 0.0 - 10.0

Default: 0.25

Frequency Balance

Determines the emphasis given to edges and flat areas in color and grayscale images. Images requiring precise edge definition will benefit from a lower setting. If precise edges are not as important as consistency in flat color areas, increase this setting. The practical range of values is 0.1 to 10 where 0.1 represents maximum edge definition with less emphasis on flat areas, and 10 represents minimum edge definition with smoother areas of relatively consistent color.

Acceptable values: 0.0 - 10.0

Default: 2

Sharpness

Determines the sharpness of boundaries between different areas of an image. Images with large amounts of textured area (where color or intensity changes are occurring throughout a region, rather than just at a boundary) will benefit from a lower setting. Use a higher setting for images with little textured areas. The range of values is 0.0 to 1.0 where 0.0 represents minimum sharpness and 1.0 represents maximum sharpness.

Acceptable values: 0.0 - 1.0

Default: 0.0

Block Size

GeoExpress accesses image data in 'blocks' of pixels.

> *IMPORTANT: Blocks in MG3 and MG4 encoding are different from blocks in MG2 encoding. The block size parameter in MG3 controls how large the bitplane-encoded regions are. Lowering this parameter may lower the memory usage of the encoder but may also decrease the lossless compression ratio. Raising this parameter may increase memory usage, but may improve the lossless compression ratio. This parameter has little effect on overall encode time. Typical values range from 32 to 64.*

Acceptable values: 5 - 64

Default: 64

Strip Height

Strip height affects performance and memory usage. The strip height parameter controls how many rows of the input image are processed at one time. Lowering this parameter may reduce memory usage, but may increase the encoding time. Raising this parameter may increase memory usage, but may also decrease encoding time. Unlike the block size, changing this parameter will not have any effect on the compression ratio of the output image.

Typical values range from 2 to 128. The encoder may perform more efficiently if the block size is a multiple of the strip height.

Acceptable values: even integers between 2 and source image height

Default: 64

1-Pass or 2-Pass Optimizer

This option is only available for MrSID Generation 3 (MG3) images. The 1-pass and 2-pass optimizer parameters affect encoding performance and memory usage. Although not as fast as the 1-pass optimizer, the 2-pass optimizer requires much less memory because it splits the encoding operation into two passes. This is required for very large files.

Note that the **Estimated Memory Usage** value is only displayed when the 2-pass optimizer is used.

The 2-Pass optimizer is automatically used for Area of Interest encoding even if this check box has not been selected.

By default the 2-Pass Optimizer is used.

> *NOTE: Encoding with the 1-Pass Optimizer is faster but requires that the entire image be loaded into memory. If the computer does not have enough memory, the job does not succeed.*

Optimizable

Determines whether the output MrSID file contains optimization data. By default the **Optimizable** check box is selected.

The option for optimizing images is specific to MG3 and MG4 files. When you optimize an image, you make it possible to perform some image manipulation operations on the image without re-encoding or recompressing the image. Image manipulation operations that benefit from optimization include the following:

- Resampling
- Cropping
- Demosaicking
- Area of interest encoding

Creating an optimized image does not affect encoding time. However, saving optimization data for an image modestly increases the size of an image by approximately one to five percent. If image size is critical and you do not plan to perform further image manipulation operations, deselect the **Optimizable** option.

Use a Temporary File

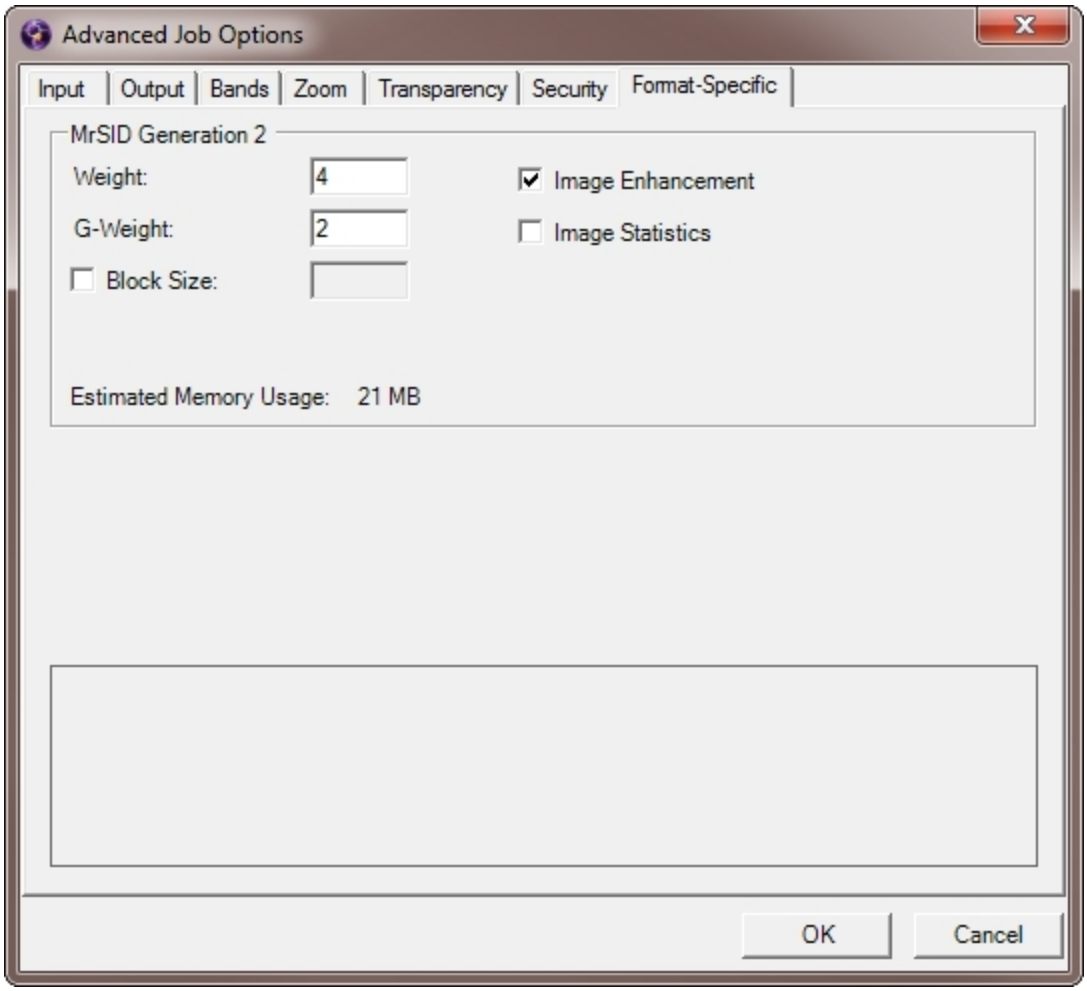
Select the **Use Temp File** option to allow GeoExpress to create temporary files during image encoding. To specify the default directory for temporary files, see *Preferences* on page 159.

Advanced MG2 Options

You can use the options for the MG2 output format to configure the display of an image, configure performance, and generate image statistics.

The settings for weight and g-weight affect the color quality and line definition of encoded MrSID files. These two settings can be adjusted independently of one another. The weight setting does not affect grayscale images whereas the G-weight setting affects both color and grayscale images.

The following figure displays the options that you can select for the MG2 output format:



Weight

Weight affects the grayscale portion of a color image, which is the part of the image with no color information. A higher weight setting increases the emphasis on this grayscale aspect of a color image, while decreasing emphasis on color quality. A lower setting increases the consistency of color between the MrSID image and the original data.

Images with high color contrast will benefit from a lower weight setting. Images with greater detail benefit from a higher weight setting.

Acceptable values: 0.0 - 10.0

Default: 2

G-Weight

The G-weight parameter increases or decreases the definition of edges in an MG2 image. A lower setting for G-weight creates more defined edges with less emphasis on flat areas. A higher setting creates softer edges while smoothing the image in flatter areas with relatively consistent color.

In applications requiring precise edge definition, decrease the setting for G-Weight. If precise edges are not as important as consistency in flat color areas, increase the setting for G-Weight.

Acceptable values: 0.0 - 10.0

Default: 2

Block Size for MG2

MrSID accesses image data in 'blocks' of pixels. Blocks in MG2 encoding are different from blocks in MG3 and MG4 encoding.

Different block sizes affect system resources. While a smaller block size in MG2 encoding uses less RAM, the opening and closing of multiple image blocks may impact a system in other ways, sometimes resulting in an encoding failure. If sufficient RAM is available, a larger block size is recommended for encoding projects approaching or exceeding a gigabyte in size.

By default, GeoExpress automatically selects a block size for MG2 encoding based on a calculated memory usage curve that is dependent on the input image. The block size corresponding to the lowest point in the memory curve is selected.

Block size may be set manually by selecting the **Block Size** check box and entering a value in the field that becomes available. When compressing imagery in excess of a gigabyte in size, use a block size of 1024. For imagery equal to or greater than three gigabytes, a block size of 2048 is recommended.

Changing the block size setting will not affect the rate of compression or the quality of the output image.

Minimum value: 32.

Image Enhancement

The **Image Enhancement** option improves the appearance of some images by adding information to the images. This means that pixels of different colors are added to the areas of flat color to make the artifacts less visible to the eye. The appearance of the resulting images may appear softer. This option is particularly useful for images that have large areas of similar color or continuous tone, such as a large blue sky, or a single background color where artifacts may become perceptible.

By default, image enhancement is enabled. LizardTech recommends that you experiment with a variety of images to determine which images benefit from this option.

Image Statistics

The **Image Statistics** option 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

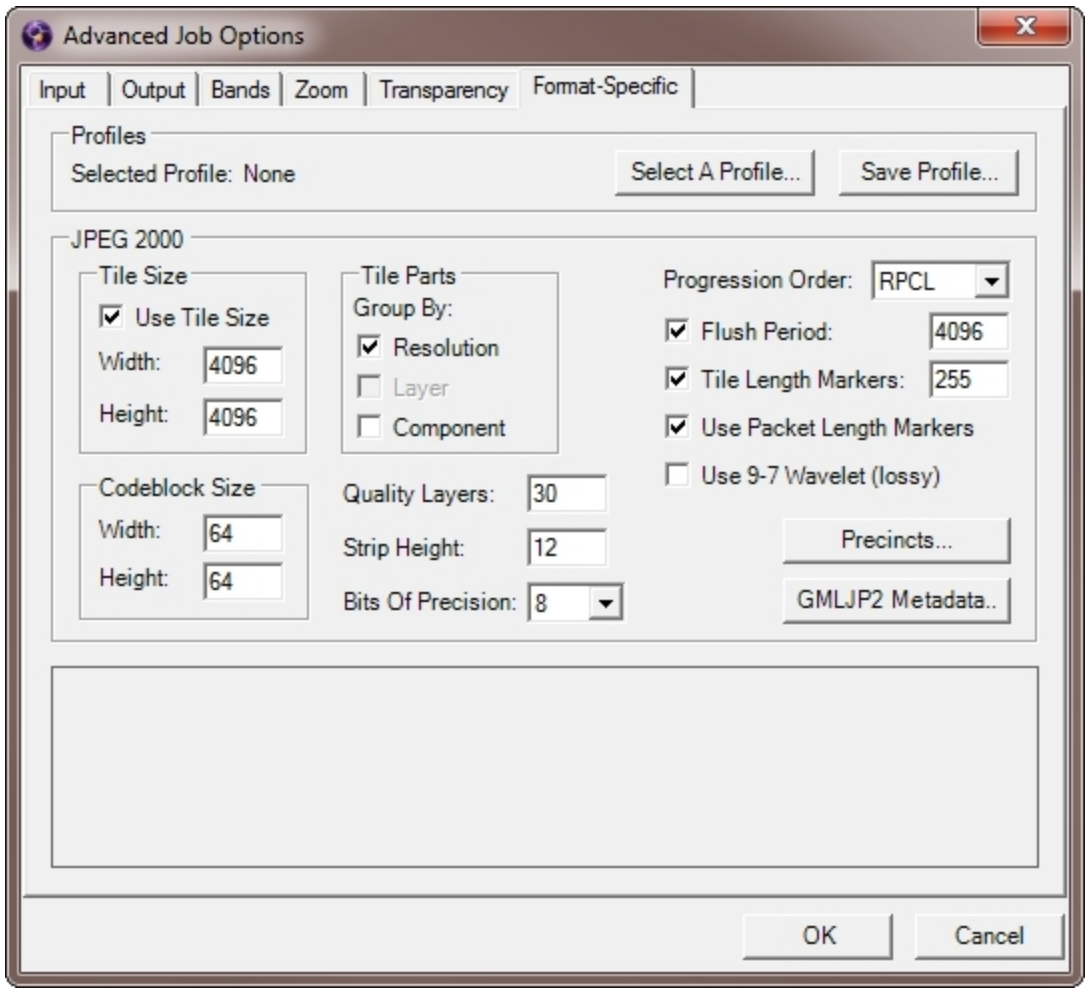
IMAGE::STATISTICS:MIN

IMAGE::STATISTICS:STANDARD_DEVIATION

By default, image statistics is disabled.

Advanced JPEG 2000 Options

For JPEG 2000 images,you can select JPEG 2000 profiles and other options.



IMPORTANT: 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 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.

When JPEG 2000 is selected as the output file type, the following advanced options are available:

Profiles

This panel enables you to invoke a list of supported profiles comprised of preset encoding options for particular workflows, and to save your own custom profiles. For more information see *Using JPEG 2000 Profiles* on page 139.

Tile Size

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 x 4096.

Tile Parts

Specifies the organization of tile parts in the codestream. Tile parts can be grouped by resolution, layer or component, depending on which progression order you use.

Some progression orders preclude grouping by one or more of the options. For example: the factory default progression order of RPCL sets the **Tile Parts** option to **Resolution**, while making the **Component** option available and the **Layer** option unavailable.

Codeblock Size

JPEG 2000 codeblock size is subject to the following restrictions:

- width and height must be powers of two
- width and height must be greater than 4
- width x height must be less than 4096
- width and height must be less than width and height of tile size
- width and height must be less than width and height of image if tile size is not specified

The default codeblock value is 64 x 64.

Quality Layers

This value 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

Strip Height (JP2)

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.

Default: 12

Bits of Precision

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.

Default: Enabled

Flush Period

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

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.

Default: RPCL

Tile Length Markers

Determines whether or not Tile Length Markers (TLMs) are to be put into the JPEG 2000 codestream. Use of TLMs may provide better decode performance.

Default: 255

Use Packet Length Markers

Enables or disables the use of packet length markers. Use of packet length markers may improve decoding performance.

Default: Enabled

Use 9-7 Wavelet

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 is only available when the "Encode Losslessly" option is not selected. By default, the NPJE and EPJE profiles use the 9-7 wavelet.

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.

To edit preferences, see *Setting Preferences* on page 159.

Default JP2 Settings

Option	Setting
Use of tiles	Enabled
Tile Size	4096 x 4096
Quality Layers	30
Strip Height	12
Flush Period	4096
Progression Order	RPCL
Code Block Size	Width: 64 Height: 64
Tile Length Markers	255

Option	Setting
Tile Parts	By resolution
Packet Length Markers	Enabled
9-7 Wavelet (Lossy)	Disabled
Precincts	256 x 256
Metadata Forms Included in Output	MrSID, World file, GeoTIFF (GeoJP2)

Precincts

Using precincts may improve the performance of decode operations for certain image encodings such as those in which tiles are not used. The **Precinct Editor** enables the user to enter precinct sizes for all of the zoom levels of the image.

Default: GeoExpress uses precincts in which width and height values are both 256.

To access the **Precincts Editor**:

1. Make sure that **JPEG 2000** is selected as the output format.
2. Click **Precincts…** on the **Format-Specific** tab of the **Advanced Job Options** dialog box.

   The **Precincts Editor** dialog box appears.

To disable use of precincts, clear the **Use Precincts** check box.

To edit a precinct value:

1. Access the **Precinct Editor** as described above.
2. Select a precinct number in the precinct list and click **Edit Precinct...**. A new editing dialog box appears.
3. Change width and height values and click **OK**.

Precinct sizes must be powers of two, except for the last one in the list, which has the lowest resolution.

GMLJP2 Metadata

Click the **GMLJP2 Metadata** button to write GML metadata to the JPEG 2000 image or to specify a GML data file.

When the GMLJP2 check box is selected, 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/.

If you would rather use an external file that contains all the coverage and other GML data, you may specify that file when the "Write GMLJP2 metadata box" check box is cleared.

By default this check box is selected.

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).*

Using JPEG 2000 Profiles

GeoExpress includes a selection of industry accepted profiles – groups of preset JPEG 2000 encoding options for particular workflows – and an interface for managing them. The **Profile Manager** enables you to select and edit profiles and create and save new ones.

Accessing the Profile Manager

1. Make sure JPEG 2000 is selected at the output file format.
2. Click the **Advanced** button on the **Properties** tab.
3. Click the **Format-Specific** tab.

4. Click the **Select A Profile...** button in the **Profiles** panel.

   The **Profile Manager** appears.

Selecting a Profile

In the **Profile Manager**, select a profile from the drop-down menu and click **OK**. The selected profile is listed on the **Format-Specifc** tab and the options are set to match the profile.

Preloaded Profiles

GeoExpress provides profiles composed of preset encoding options for particular workflows. These are EPJE, NPJE, Large Image, Large Image without TLMs, and Default. In the current implementation of GeoExpress, the EPJE profile is identical to the NPJE profile except for progression order. The profile named Default is not the same as the default GeoExpress encode settings.

When a profile is selected from the drop-down list, it may display a user-defined description in the **Description** field to help identify it. Clicking **OK** applies a selected profile.

You can also choose to load a custom profile stored anywhere on your network.

> *NOTE: Selecting "(None)" from the profile list sets the JPEG 2000 options to the defaults set in the GeoExpress preferences.*

EPJE

Stands for "Exploitation Preferred JPEG 2000 Encoding". The EPJE profile sets the values to the encoding parameters preferred by the National Geospatial-Information Agency (NGA) for image exploitation.

NPJE

Stands for "NGA Preferred JPEG 2000 Encoding". The NPJE profile sets the values to the encoding parameters preferred by the National Geospatial-Intelligence Agency (NGA) for archiving.

Large Image

This profile is optimized for encoding very large images.

Large Image w/o TLMs

This profile disables tile length markers for better rendering in viewers that don't support them.

Default

This profile represents LizardTech's general purpose JP2 encode settings, determined at the SDK level. These are NOT the same as the GeoExpress factory default encode settings, which are recommended for large images.

> *NOTE: 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 sales representative to learn more.*

Modifying a Profile

After a profile is selected and applied, the profile name appears in the **Selected Profile** field on the **Advanced** tab. If any encode settings are modified after applying a profile, the **Selected Profile** field indicates that the current settings differ from the original profile settings, unless no profile was selected. For example, if you apply the EPJE profile and change one or more options, the profile is now listed as EPJE (modified).

Saving Custom Profiles

You can save the current encode settings as a custom profile.

1. On the **Format-Specific** tab of the **Advanced Job Options** dialog box, click **Save Profile...**.

   The **Save Profile** dialog box appears.

2. Enter an output file name and a name for the profile if desired.
3. Optionally, add a description.
4. Click **OK**.

You can only save a profile if all of the encode parameters are discrete and unambiguous values. The default location for user profiles on Windows is "C:\Documents and Settings\<user name>\My Documents\LizardTech\GeoExpress\9\profiles". Any profiles in this directory will auto-

matically be available in the profile selector's drop-down list. To save a profile, you must enter a unique profile name.

Loading Custom Profiles

1. Access the **Profile Manager** as described above.
2. Click **Load Custom Profile...** and browse for the desired custom profile, then click **Open**.
3. Optionally, add a description and click **OK**.

Notes on Profiles

A profile is a collection of settings, not a singular entity. After a profile is applied to a job, only the particular settings – not the profile – are saved in the job. The profile itself is stored on disk. If a profile is edited or deleted after it is applied to a job, those changes are not retroactively applied toward any existing encode jobs.

Not all of the settings in the dialog are preserved in a profile – only the ones that affect how the output file is encoded. Most notably, thumbnail size and strip height are not included in the profile system. Profiles are used to store information about what JPEG 2000 options were used in choosing the organization of the file format (algorithmic codec settings), not encoder implementation choices. Changing the strip height or thumbnail size does not affect the layout of the file, since they are really encoding performance parameters.

Chapter 10: Mosaics

Mosaics Overview

A mosaic is a group of images or point clouds that you want to view together. Each of the images or point clouds that make up a mosaic is called a tile.

You can manage the tiles in a mosaic to add tiles, remove tiles,or change the order of tiles. For raster images, you can also crop tiles.

For raster mosaics, you can perform the same manipulation operations that you perform for single images. For example, you can crop or despeckle a raster mosaic.

> *NOTE: You can only create LiDAR mosaics in the MrSID Generation 4 format.*

Creating a Mosaic

Use the **Create New Mosaic** button in the toolbar to create a mosaic. The mosaic options that you can select depend on the mosaic format that you select.

1. Click the **Create New Mosaic**  button in the toolbar.

   The **Create New Mosaic** dialog box appears.

2. Select the mosaic type. You can select either **Raster** or **LiDAR**.

3. Click **Browse** to select the directory where you want to save the mosaic, and enter a file name for the mosaic.

   If the mosaic is a LiDAR mosaic, click **OK**.

4. For raster mosaics, select the mosaic output format that you want to use in the **Format** drop-down.

   For more information on mosaic formats, see *Mosaic Output Formats* on page 144.

5. Optionally for raster mosaics, select **Enable multiresolution mosaicking** to create a mosaic from input files with different image resolutions.

   For more information, see *Multiresolution Mosaics* on page 146.

6. Optionally for raster mosaics, select **Allow multiple projection systems** to create a mosaic from input files with different projection systems.

   For more information, see *Mosaics with Multiple Projection Systems* on page 146.

7. For raster MrSID mosaics, select the flat or composite mosaic option. For NITF mosaics, select the mosaic option for single or multiple image segments.

   For more information, see *Mosaic Output Formats* on page 144.

8. Click **OK**.

   The **Select tiles** dialog box opens.

9. Select one or more images that you want to add to the mosaic and click **Open**.

NOTE: Because images with different compression types and color lookup tables can be combined when multiple images are joined together, color lookup table information may not be reported for image mosaics.

Mosaic Output Formats

GeoExpress can create raster mosaics in the MrSID format, the JPEG 2000 format, and the NITF format. GeoExpress can create LiDAR mosaics in the MrSID Generation 4 format.

If you create a mosaic from existing MrSID images or JPEG 2000 images, GeoExpress does not deduct data from the data cartridge. Additionally, if you create a mosaic from NITF files that

contain JPEG 2000 images, GeoExpress does not deduct data from the data cartridge. For more information on output formats, see *Supported Output Formats* on page 30.

MrSID Raster Mosaics

Use the MrSID file format to create flat mosaics and composite mosaics. A flat mosaic is a single image that you create from multiple input images. A composite mosaic is a group of images that display as a single image.

Flat Mosaics

When you create a flat mosaic, GeoExpress creates a single image from the input tiles. Because a flat mosaic is a single image, it displays more quickly than a composite mosaic. You can perform any image manipulation operation on a flat mosaic that you can perform on a single image.

Composite Mosaics

When you create a composite mosaic, GeoExpress creates a MrSID file that contains multiple input tiles. You can only create composite mosaics out of input tiles in the MrSID format. To create a composite mosaic out of images in other formats, first convert the input images to the MrSID format, then create a mosaic out of the MrSID files.

Because a composite mosaic is a container for existing files, you can create a composite mosaic without running an encoding operation. Use composite mosaics when you want to create mosaics quickly, for example, when you want to create mosaics from large input tiles.

A composite mosaic in the MrSID Generation 4 (MG4) format can only contain MG4 input tiles. A composite mosaic in the MrSID Generation 3 (MG3) format can contain MG3 and MG2 input tiles.

An MG4 composite mosaic contains an overview image for viewing at low resolutions. As a result, MG4 composite mosaics display more quickly than MG3 or MG2 composite mosaics. However, MG4 composite mosaics may take slightly longer to create.

JPEG 2000 Raster Mosaics

When you create mosaics in the JPEG 2000 format, GeoExpress runs an encoding operation that creates a single image from the input tiles. JPEG 2000 mosaics are equivalent to flat MrSID mosaics.

NITF Raster Mosaics

Use the NITF file format to create mosaics with single or multiple image segments. An image segment is an image in a NITF file. When you create a mosaic in the NITF file format, you can combine the input tiles into a single image or you can add each image to the NITF file separately. If you add images to the NITF file separately, the mosaic is called a multiple image segment mosaic. If you combine the input images into a single image, the mosaic is called a single image segment mosaic. A mosaic made up of a single image segment is equivalent to a flat MrSID mosaic. A mosaic with multiple image segments is similar to a composite mosaic in that it preserves the information from each input tile. However, multiple image segment mosaics require an encoding operation unlike composite mosaics, therefore they take longer to create.

Multiresolution Mosaics

A multiresolution mosaic is a raster mosaic made up of input images with different resolutions. When you create a multiresolution mosaic in any format, the resulting mosaic is a single image, in other words, it is a flat mosaic. The exception to this is the MrSID Generation 4 (MG4) format. You can create an MG4 composite mosaic out of multiresolution images if all of the input tiles are also in the MG4 format.

To add images with multiple resolutions to a mosaic, select the **Enable multiresolution mosaicking** option when you create the mosaic. To select this option after you create a mosaic, complete the following steps:

1. Select a mosaic in the **Job List**.
2. Click **Advanced** in the **Properties** tab.

   The **Advanced Job Options** dialog box appears.
3. In the **Output** tab, select **Enable multiresolution mosaicking**.

Mosaics with Multiple Projection Systems

GeoExpress can create raster mosaics out of images with multiple projection systems. However, because images with different projection systems display discrepancies in their positioning, GeoExpress reprojects all of the images to the same coordinate reference system (CRS). By

default, GeoExpress reprojects images to the WGS 84 projection system. To use a different projection system, see *Reprojecting an Image* on page 86.

To add images with multiple projection systems to a mosaic, select the **Allow multiple projection systems** option when you create the mosaic. To select this option after you create a mosaic, complete the following steps:

1. Select a mosaic in the **Job List**.
2. Click **Advanced** in the **Properties** tab.

   The **Advanced Job Options** dialog box appears.
3. In the **Output** tab, select **Allow multiple projection systems**.

> *NOTE: When you select **Allow multiple projection systems**, GeoExpress also selects the **Enable multiresolution mosaicking** option. Because reprojecting an image changes the geographic area covered by the image, reprojection often changes the resolution of an image. As a result, GeoExpress automatically selects the **Enable multiresolution mosaicking** option to correct discrepancies in image resolution.*

If one or more of the tiles in the mosaic does not have a valid CRS, or if you are using world files, you can manually assign a CRS to each tile in the **Tile Manager**. For more information, see *Assigning a CRS to Tiles* on page 150.

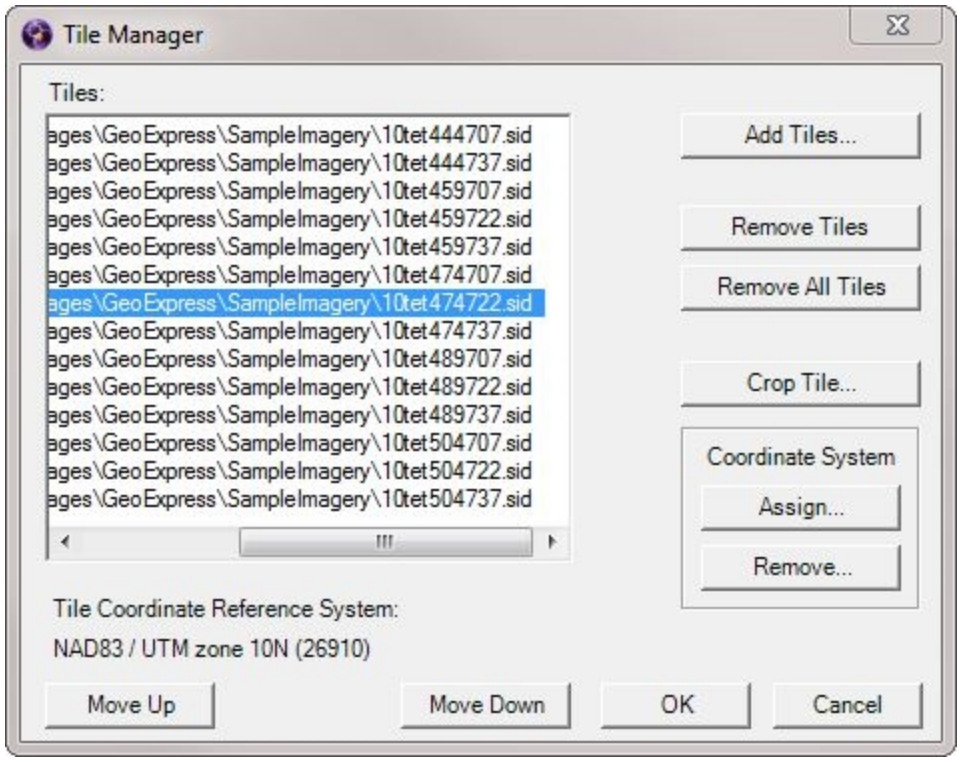
Tile Management

Manage the tiles in a mosaic job to complete the following tasks:

- Add tiles to the mosaic job.
- Remove tiles from the mosaic job.
- Change the order of tiles. If tiles in a mosaic overlap, the mosaic displays whichever tile you place lower in the tile list.
- Crop the tiles in a raster mosaic.
- Assign a coordinate reference system (CRS) to individual tiles of a raster mosaic. This option is only available if you have enabled multiple projections for the mosaic. For more information, see *Mosaics with Multiple Projection Systems* on page 146.

You can manage tiles in the **Tile Manager**. To access the **Tile Manager**, right-click a mosaic in the **Job List**, and click **Tile Options**. Alternatively, click the **Options** menu and select **Tile options**.

The following figure shows the **Tile Manager**:



*NOTE: The **Tile Manager** is for raster mosaics only. However, you can manage raster and LiDAR mosaics quickly from the **Job List**:*

- *Drag tiles into the **Job List** to add them to a mosaic.*
- *Right-click a mosaic tile in the **Job List** and click **Remove** to remove it from the mosaic.*
- *Click and drag tiles in the **Job List** to change their order.*

Adding Tiles

1. Right-click the mosaic in the **Job List** to which you want to add tiles and click **Tile Options**.

   The **Tile Manager** appears.

2. Click **Add Tiles**.
3. Select one or more images that you want to add to the mosaic and click **Open**.
4. Click **OK**.

*TIP: Alternatively, for raster and LiDAR mosaics, drag images into a mosaic in the **Job List** from your system's file manager.*

Removing Tiles

1. Right-click the mosaic in the **Job List** to which you want to add tiles and click **Tile Options**.

   The **Tile Manager** appears.

2. Select one or more tiles that you want to remove from the mosaic job and click **Remove Tiles**.

   Alternatively, click **Remove All Tiles** to clear the tile list.

3. Click **OK**.

*TIP: To remove raster and LiDAR tiles quickly, select tiles in the **Job List** and press **Delete**.*

Changing the Order of Tiles

1. Right-click the mosaic in the **Job List** to which you want to add tiles and click **Tile Options**.

   The **Tile Manager** appears.

2. Select one or more tiles and click **Move Up** or **Move Down**.

   Alternatively, drag the selected tiles to another place in the tile list.

3. Click **OK**.

NOTE: If tiles in a mosaic overlap, the mosaic displays whichever tile you place lower in the tile list.

*TIP: To move raster and LiDAR tiles quickly, select tiles in the **Job List** and drag them to another position.*

Cropping Tiles

1. Right-click the mosaic in the **Job List** to which you want to add tiles and click **Tile Options**.

   The **Tile Manager** appears.

2. Select a tile in the tile list and click **Crop Tile**.

   The **Image Crop** dialog box appears.

3. Select a cropping format and enter a crop region.

   Alternatively, click **Show Image** to select a cropping region using the graphical cropping tool.

4. Click **OK**.

For more information on cropping images, see *The Image Crop Tool* on page 64.

NOTE: You can only crop the tiles of a raster mosaic.

Assigning a CRS to Tiles

You can only assign a CRS to tiles if you have enabled multiple projection systems for the mosaic. For more information, see *Mosaics with Multiple Projection Systems* on page 146.

1. Right-click the mosaic in the **Job List** to which you want to add tiles and click **Tile Options**.

   The **Tile Manager** appears.

2. Select one or more tiles in the tile list and click **Assign**.

   The **Coordinate Reference System Selector** opens.

3. Select a CRS from the **System** drop-down or select **Use Custom WKT** to select a well known text (WKT) string.

NOTE: You can only assign a CRS to raster tiles.

Mosaic Manipulation

Most raster image manipulation operations that you can perform are the same for mosaics and for single images.

However, when you perform color balancing for a raster mosaic you can also perform additional color corrections to match the appearance of tiles to each other. You can perform color balancing for mosaics with the following output formats:

- MrSID Generation 4
- MrSID Generation 3
- JPEG 2000
- NITF

For the MrSID output formats, you can only perform color balancing for flat mosaics. For the NITF format, you can only perform color balancing single image segment mosaics.

When you preview a mosaic, you can preview individual tiles or selected tiles.

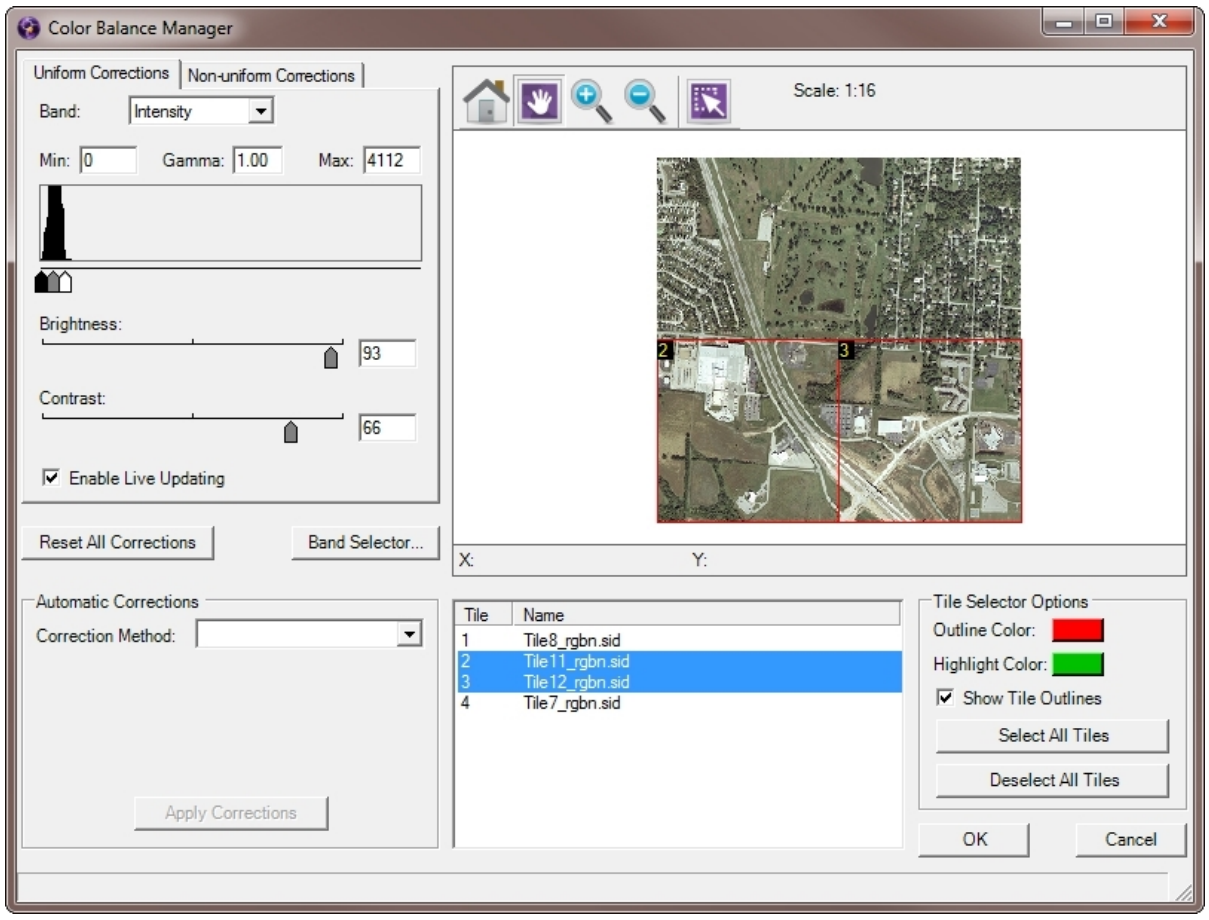
Performing Color Balancing for a Mosaic

When you perform color balancing for mosaics, you can perform uniform corrections, non-uniform corrections, and automatic corrections.You can apply corrections to the RGB bands or the Gray-scale band, and you can apply multiple corrections to the same mosaic.

For more information on the types of corrections that you can apply, see *The Color Balance Tool* on page 79.

1. Select a mosaic in the **Job List**.
2. Click the **Color Balance** button  on the toolbar.

   The **Color Balance Manager** appears.



3. Select the color balancing corrections that you want to perform and select the tiles to which you wan to apply the corrections. Select tiles in the tile list or click the **Tile Select** button  to select tiles in the preview image.
    - To perform uniform corrections, click the **Uniform Corrections** tab. Select one or more tiles that you want to correct. If you do not select a tile, the corrections that you perform are applied to all the tiles.
    - To perform non-uniform corrections, click the **Non-Uniform Corrections** tab and select one or more options.
    - To perform automatic corrections, select a correction method from the **Automatic Corrections** panel in the lower left corner of the **Color Balance Manager**. Then, click **Apply Corrections**.
4. Click **OK**.

NOTE: Uniform corrections will be more effective among image tiles composed of similar ground cover types than, for example, an array of tiles showing dense urban development and vegetation or bodies of water, and may require additional manual manipulation to make the tiles match their neighbors. Automatic corrections work on a tile by tile basis, so any boundaries, seams, or lens effects that occur inside of a tile will still be visible regardless of uniform corrections.

Previewing a Mosaic

Select a raster or LiDAR mosaic in the **Job List** and click the **Preview** tab to preview all the tiles in the mosaic. Alternatively, select one or more tiles in the **Job List** that you want to preview.

For raster mosaics, when you select bands using the **Band Selector** button  , your selections apply to all of the tiles in the mosaic, even if only one tile in the mosaic is selected.

When you crop a raster mosaic, the preview image only displays the cropped area of the image. If you select a tile in the **Job List** that is not included in the cropped area of the image, the preview image is blank.

For more information on the preview tab, see *Preview Tab* on page 21.

Updating a MrSID Image

For raster mosaics, you can create a composite mosaic to update one part of an image with new imagery. This is useful when, for instance, a particular region of an aerial photo mosaic needs to be updated because of building development or other geographic changes but an entire new image set is not needed. By updating just the affected image tiles geospatial image users can keep pace with geographic changes without constantly acquiring new image data for every region.

To update an image, create a new raster mosaic and select the composite mosaic option.

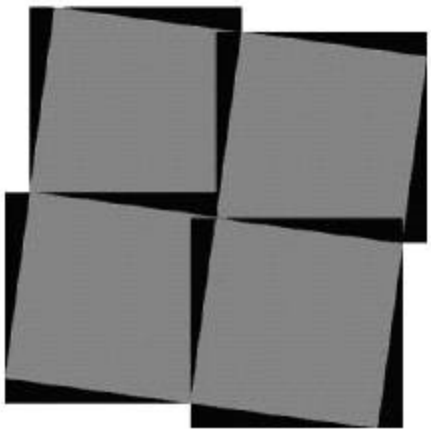
NOTE: Updating an image or set of images results in a flattened mosaic if flattening is specified by the user or if tiles of differing resolutions are used.

Mosaics with Overlapping Input

If two or more tiles in a raster mosaic overlap, the resulting mosaic displays whichever tile you place lower in the **Job List**.

If you create a mosaic out of overlapping tiles and the tiles are compressed images, despeckle the tiles to minimize compression artifacts between image tiles. For more information, see *The Despeckle Tool* on page 61.

If the transparency borders of individual tiles obscure image data in neighboring tiles, set transparency values for the mosaic. For example, when images are geographically rectified to align accurately with a fixed point such as magnetic North, the images appear tilted and contain borders of transparency along the edges. For more information on setting transparency values, see *Transparency Options* on page 113. The following figure shows an example of a mosaic with overlapping transparency borders:



Mosaics with GeoTIFF Images

If you create a mosaic that contains GeoTIFF images, you can select the georeferencing information that you want to use. A GeoTIFF image can store georeferencing information in a TIFF world file and in embedded metadata. If the GeoTIFF image has georeferencing information stored both in a world file and in its metadata, GeoExpress uses the embedded metadata by default. To use the georeferencing information in the world files, select the **Allow World Files to Override Native Georeferencing** preference. For more information on setting preferences, see *Preferences* on page 159.

If you encode a GeoTIFF image using georeferencing information from a TIFF world file, other spatial referencing information such as the coordinate reference system (CRS) found in the GeoTIFF metadata tags is saved in the MrSID metadata. In a mosaic composed of both TIFF

and GeoTIFF images, GeoExpress saves metadata in the mosaic if the first input tile is a GeoTIFF image with metadata.

Creating a Mosaic with a Mosaic List File

Rather than use GeoExpress to select images or point clouds that you want to mosaic, you can create a text file which lists the images and point clouds that you want to mosaic. For raster mosaics, the text file must have a .mos extension. For LiDAR images, the file must have a .list extension.

For raster mosaics, you can create mosaic lists for images that do or do not have gereferencing information. For LiDAR mosaics, the images must have georeferencing information.

By default, the output image from a mosaic list is written to the directory where the mosaic list file is located. The file is given the same name as the mosaic list file, but with a ".sid" extension.

To add a mosaic list file, complete the following steps:

1. Click the **Create New Mosaic** button  on the toolbar.

   The **Create New Mosaic** dialog box appears.
2. Select a mosaic type and mosaic options.
3. Click **OK**.
4. Select **All Files** from the **"Files of type:"** drop-down menu.
5. Select the mosaic file and click **Open**.

Images with Georeferencing

For georeferenced images and point clouds, the text in the mosaic list file contains the file paths of the images that you want to mosaic. In the following example, a mosaic is created from four TIFF files: "image_nw.tif", "image_ne.tif", "image_sw.tif", and "image_se.tif".

Ensure that each image has an associated *.tfw file (the names of the corresponding files must match exactly, differing only in the .tfw file extension). This *.tfw file must be in the same directory as the file to which it refers. A sample file for this project is:

```
C:\maps\image_nw.tif

C:\maps\image_ne.tif

C:\maps\image_sw.tif
```

```
C:\maps\image_se.tif
```

When presented with a list of images, GeoExpress immediately looks for corresponding georeferencing information. The “Input File Size” and “Target File Size” reflect both the on-disk size of the source data and the estimated output file size of the full mosaic. When encoded, the images are combined in a seamless mosaic based on the information given in the georeferencing files.

> *NOTE: GeoExpress does not recognize mosaic list 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.*

Images without Georeferencing

When creating a raster mosaic using images with no georeferencing information, the text 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 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 first line in the file must not be left blank.

The sample auxiliary file above joins the specified images as follows:

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

Tips for Encoding Large Mosaics

As you add more tiles to a mosaic, performance becomes increasingly important. The following list provides some advice on encoding performance for mosaics:

- Change the encoding options for strip height and block size for faster encoding on machines with more memory. As a rule of thumb, you can create mosaics up to 500,000 pixels in width if you set the strip height to 12 and the block size to 64 on a machine with 2 GB of RAM. For more information see *Calculating Memory Usage* on page 195.
    a. Strip height. Set a higher strip height for faster encoding but more memory usage. For more information, see *Strip Height* on page 129.
    b. Block size. Set a lower block size to use less memory. However, selecting a lower block size will result in a lower quality compression. By default, the block size is set to the maximum of 64. Do not change the block size unless you need to restrict memory usage. For more information, see *Block Size* on page 129 .
- Create mosaics in a single job even when there are many input tiles. It takes longer to encode many small mosaics and then encode the small mosaics into one large mosaics. If you need to create both small mosaics and large mosaics, create one large mosaic first, and then create tiles in the **Job Options**.
- Work from uncompressed images when possible. If you want to perform multiple image manipulation operations on a mosaic, perform the image manipulation operation on the uncompressed input tiles. Many image manipulation operations that you perform on a compressed mosaic decode the mosaic first, perform the image manipulation operations, and

then compress the mosaic again. Exceptions to this rule are crop operations, resampling operations, and composite mosaic operations for the MrSID Generation 3 and Generation 4 formats.

Chapter 11: Administration

Administration Overview

Complete administrative tasks to set preferences for GeoExpress and to view log file information.

Preferences

Every time that you create a job by adding an image or mosaic to GeoExpress, the job uses a set of default options from the preferences. Set your preferences to change these default options. To access the preferences for raster jobs, click **Options > Preferences** in the menu bar. To access the preferences for LiDAR jobs, click **Options > LiDAR Preferences** in the menu bar.

Setting Preferences

1. Click the **Options** menu and select **Preferences** for raster preferences or **LiDAR Preferences** for LiDAR preferences.
2. Select the tab for which you want to set preferences. Use the arrows in the upper right corner to scroll through tabs.
3. Click **OK**.

NOTE: For raster preferences, you can restore the default preferences from when you first installed GeoExpress by clicking ***Restore Program Defaults****.*

Raster Preferences

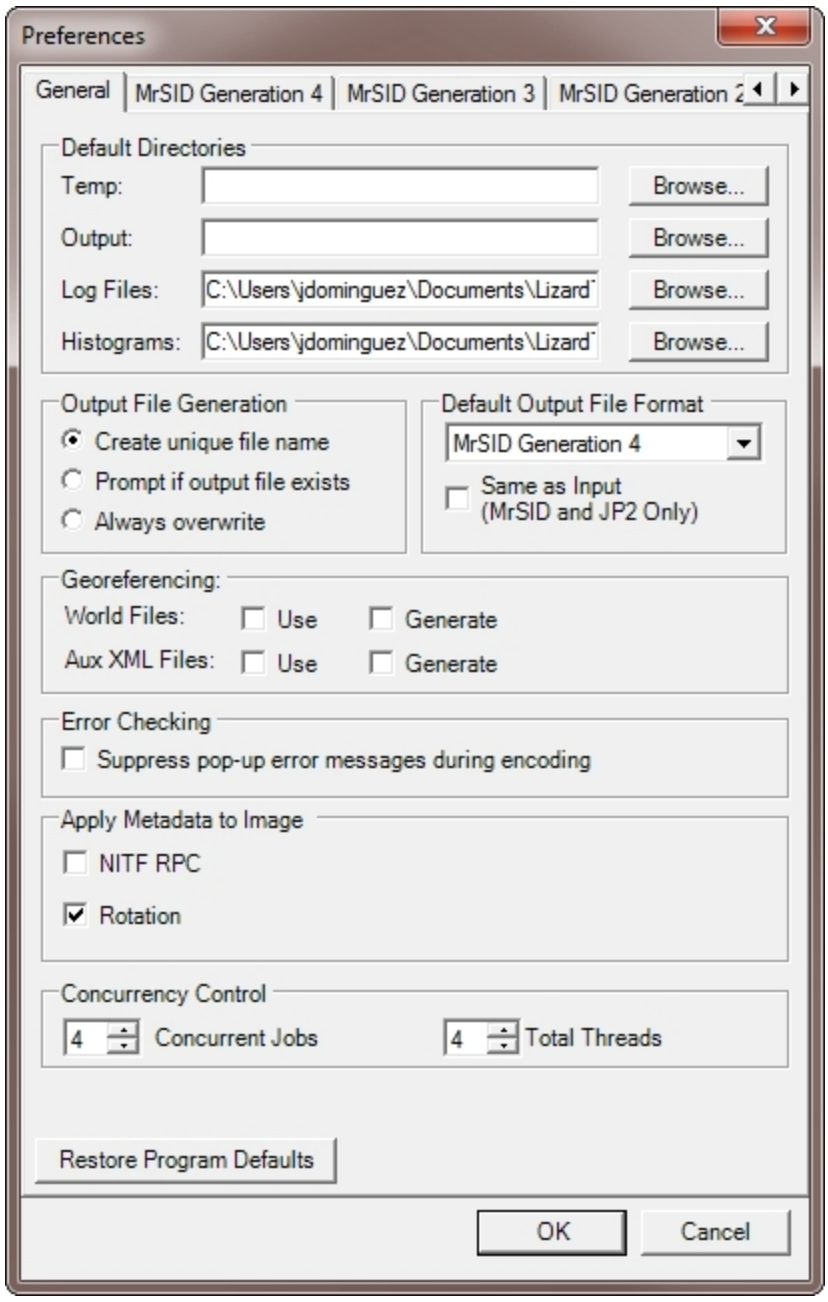
The **Preferences** dialog box can be used to set default job options and other global settings for raster files. In this dialog box you can set general preferences, default parameters for MrSID and JPEG 2000 encoding, and color and line appearance in editors and selectors.

The **Preferences** dialog box is divided into six tabs:

- General
- MrSID Generation 4
- MrSID Generation 3
- MrSID Generation 2
- JPEG 2000
- Appearance

General Preferences

Set general preferences to set the default settings for all files.



Default Directories

You can define default Temp, Output, Log File and Histogram directories by browsing or by entering a filepath.

Specifying a Default Temp Directory

When GeoExpress encodes a MrSID Generation 2 image, it creates a series of temporary files that are used in constructing the final MrSID image. Collectively, the temp files are roughly equivalent in size to the created MrSID image. These files are deleted immediately upon completion of an encoding project.

Encoding requires enough disk space to accommodate both the output image and the equivalent size of the output image in temporary files. (For more information, *System Requirements* on page 5.)

By default, GeoExpress uses the default Windows temp directory, typically C:\Temp, to store these temporary files. You can specify an alternate directory by entering the full path name in the Temp Directory field. If you are unsure of the entire path, click Browse to navigate to the preferred directory.

If an output or temp directory has been specified and afterwards deleted or moved, GeoExpress will prompt you to specify a new directory.

Specifying a Default Output Directory

By default, the output directory is the same location in which the input image resides. In the case of image mosaics, the output directory is the location in which the first image listed within the mosaic resides.

To have all MrSID images written to a single directory, enter the desired directory path in the Output field. Specifying a default output directory does not affect filenames already in the Job list. Only images and mosaics added to the Job list after the default directory is specified adopt the new output directory.

Specifying a Default Log File Directory

This check box enables the user to set the Log File output directory. If the user does not manually change the directory location the default location will be displayed.

Specifying a Default Histogram Auxiliary Directory

By default, histogram files are created in the same place as their source images, but if they cannot be created there (for example if the source images are in a non-writable directory), then they are created in an auxiliary directory specified in the Histogram field. If the histograms cannot be

created in the image source directory and this field is blank, the histogram files are saved to "C:\Documents and Settings\username\My Documents\LizardTech\GeoExpress\9\histograms".

Output File Generation

If the “Create unique file name” radio button is selected when a new MrSID file is created in a directory where a file of the same name exists, the new file name is appended with an underscore and a number. For instance, if two files named `image.sid` are created in the same directory, GeoExpress names the second file `image - copy 1.sid`. Additional files created are appended with incremental numbers (such as `image - copy 2.sid`).

If the “Prompt if output file exists” radio button is selected, you will receive a prompt when GeoExpress finds an existing file with the same name as the output file. A “Save As…” dialog box appears asking for a new file name.

If the “Always overwrite” radio button is selected, GeoExpress overwrites existing files.

Many USGS DOQ files have the same file name with a different extension. If “Always overwrite” is selected, MrSID files created from multiple USGS DOQ files overwrite one another. LizardTech recommends that the “Always overwrite” feature NOT be used when working with USGS DOQ images.

Default Output File Format

A drop-down list enables you to select the default file format to use for output files. Regular options are MrSID Generation 4 (MG4), MrSID Generation 3 (MG3), MrSID Generation 2 (MG2) and JPEG 2000. Support for encoding NITF images is available for GeoExpress (contact your LizardTech representative to purchase the NITF Extension for GeoExpress). Unless this default is changed manually, it is MrSID Generation 4.

World File Support

Generate World Files

A check box can be selected to automatically generate world files upon encoding.

Generate Esri AUX Files

A check box can be selected to automatically generate AUX files upon encoding. This enables you to make sure the georeferencing metadata in your MrSID and JPEG 2000 imagery will be

readable in Esri applications.

Allow World Files to Override Native Georeferencing

When georeferencing information for an image or mosaic tile is also given in a world file, GeoExpress uses the georeferencing information from the world file if this check box is selected.

> *IMPORTANT: This option will override any coordinate reference system (CRS) metadata – including well-known text strings (WKTs) –that may have been embedded in the file. You can manually edit the CRS in the image metadata with the **Edit Metadata** tool. For more information on selecting a CRS in the metadata, see Editing Raster Metadata on page 46.*

For more information, see *World Files* on page 182.

Error Checking

When several jobs are being encoded as a batch, errors may occur that could interrupt the encoding project. These errors may be internal (for example, GeoExpress may encounter a corrupt or incompatible image or mosaic), or they may be external (for example, a Windows or network error). To force GeoExpress to ignore any such error messages and attempt to continue with the encoding project, select the **Suppress Pop-Up Error Windows During Encoding** option . The error messages will be written to the log file.

Apply Metadata to Image

If your images contain metadata for image rotation or rapid positioning capability (RPC), you can manipulate the image so that it reflects the information in the metadata. You can select the following preferences for image metadata:

Burn in NITF RPC

NITF RPC metadata maps pixel data to location data for orthorectification. Select this option to apply the orthorectification described in the NITF RPC to the image.

> *NOTE: To apply orthorectification, the NITF RPC metadata must use the WGS 84 datum.*

Burn in 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. Select this option to create 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 112.

Concurrency Control

If you run GeoExpress on a machine with a multi-core processor or on a machine with multiple processors, GeoExpress creates multiple threads to process jobs more quickly. You can set the following preferences for concurrency:

- **Concurrent jobs**. The maximum number of jobs that GeoExpress can run at the same time. Each job uses one or more threads. If the number of concurrent jobs exceeds the number of total threads, GeoExpress does not run the full number of concurrent jobs.
- **Total threads**. The number of threads that GeoExpress uses. GeoExpress always uses the total number of threads available regardless of the number of jobs.

The maximum number of concurrent jobs and total threads that you can set equals the number of cores in your processor. For example, if your machine has six cores, you can run a maximum of six

concurrent jobs and six threads. For machines with more than eight cores, the maximum is eight. By default, the number of concurrent jobs and total threads equals the maximum.

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 machine that runs GeoExpress.

Concurrency Example

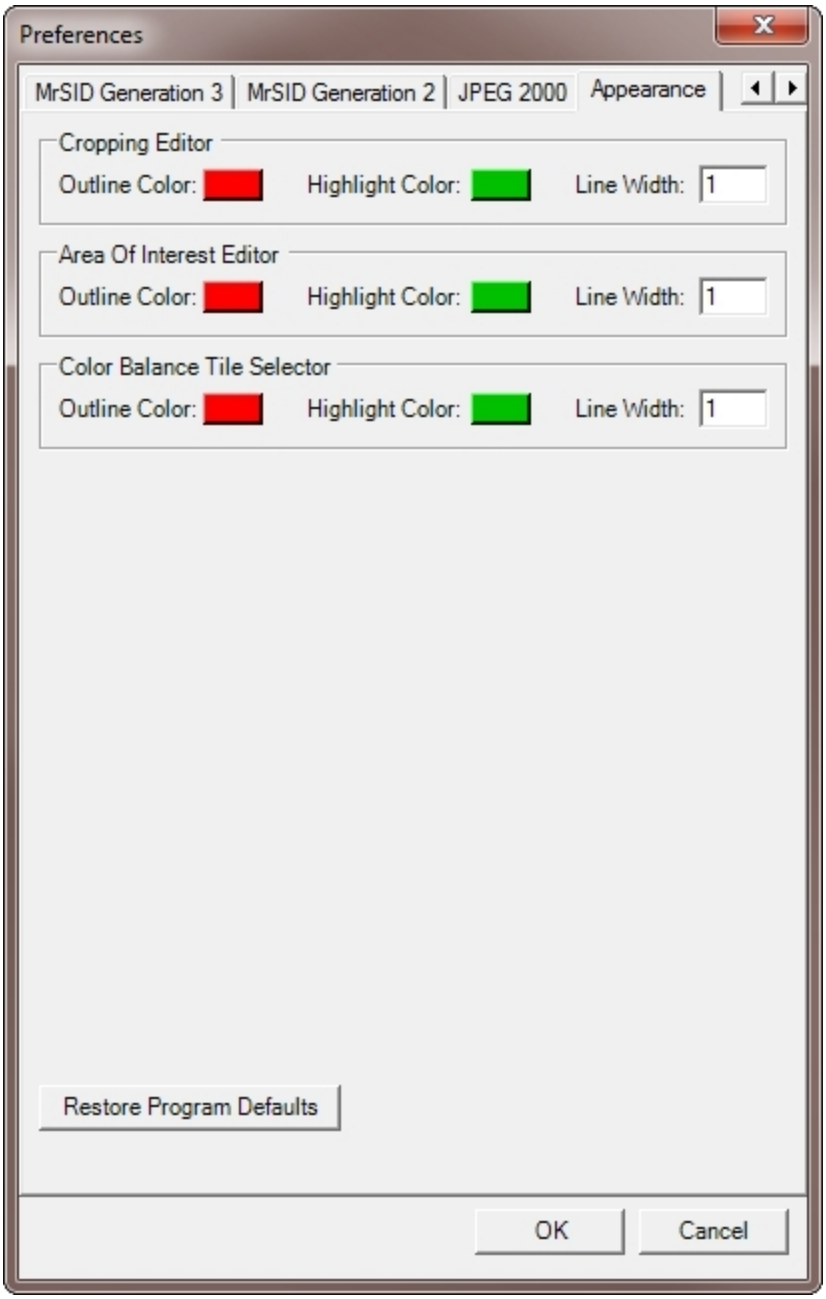
You have 12 jobs that you want to run on a machine with six cores. The following list describes how GeoExpress runs the jobs for various preference combinations:

- If you set the number of concurrent jobs to six and the number of threads to six, GeoExpress runs six jobs at a time and allocates one thread to each job. Use this combination for optimal performance.
- If you set the number of concurrent jobs to three and the number of threads to six, GeoExpress runs three jobs at a time and allocates two threads to each job.
- If you set the number of concurrent jobs to six and the number of threads to three, GeoExpress runs three jobs at a time and allocates one thread to each job. Because GeoExpress uses one thread for each job, GeoExpress cannot run the full number of concurrent jobs.

GeoExpress continues running as many concurrent jobs as possible until it finishes all 12 jobs.

Appearance Preference Options

The **Appearance** tab of the **Preferences** dialog box enables you to change the color and width of lines and highlights that are applied in the Image Crop, Area of Interest and Color Balance Tile Selector dialog boxes. Colored rectangles display the color currently selected.



Changing Colors

1. Click on the rectangle whose color you wish to change. A color picker appears.
2. Select a color and click **OK**.

To change a line width, enter the desired value in the appropriate **Line Width** field.

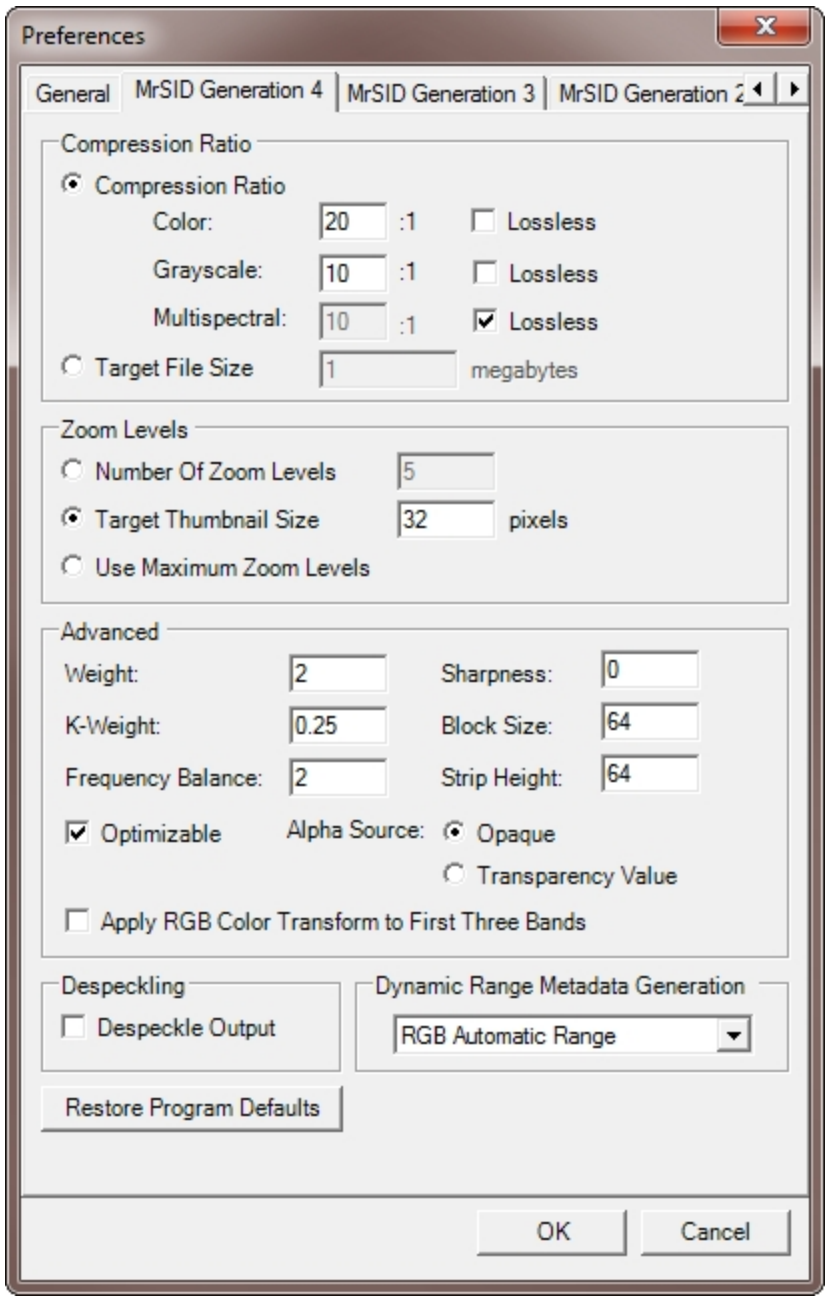
MrSID Preference Options

This page describes the preference options for MrSID Generation 4 (MG4), MrSID Generation 3 (MG3) and MrSID Generation 2 (MG2).

You can set the following preferences for MG2, MG3, and MG4 files:

- Compression ratio preferences. For more information on compression ratios, see *Compression Overview* on page 39.
- Zoom levels preferences. For more information on zoom levels, see *Zoom Options* on page 108.
- Advanced preferences. For more information on advanced options such as weight and block size, see *Format-Specific Options Overview* on page 121.

The MrSID Generation 3 (MG3) and MrSID Generation 4 (MG4) preferences mirror the settings found in the MG3 and MG4 format-specific options on the **Advanced Job Options** dialog, with the exception that a default compression ratio can be specified for both color and grayscale images. When you add a new MG3 or MG4 encode job, the compression settings are initially set to the values declared on this tab. The effects of these options can be simulated on the Preview tab.

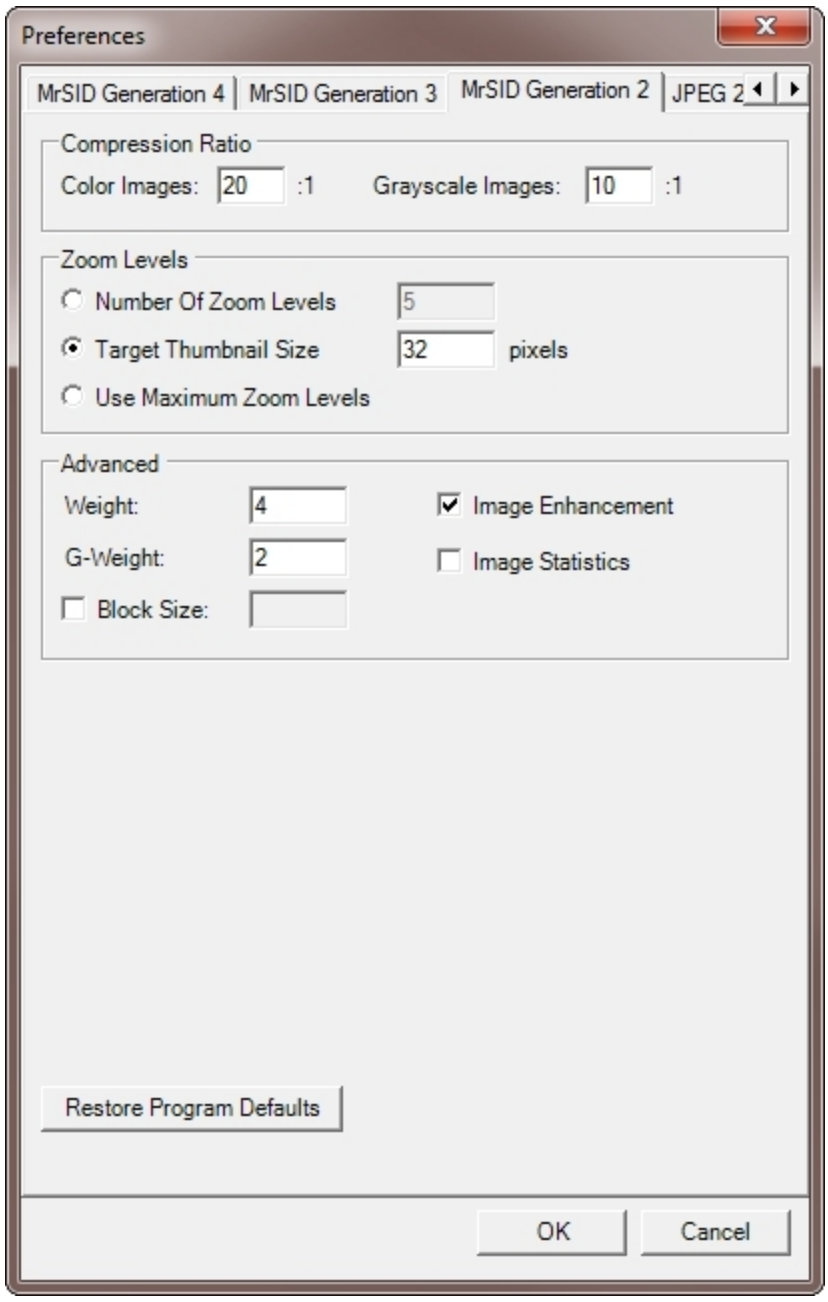


The preference options for MG3 and MG4 are the same with the following exceptions:

- Compression ratio preferences for MG4 include a setting for Multispectral, which by default is set to "Lossless", and a Lossless option can be selected individually for RGB and Grayscale.

- Advanced MG4 preference options include an "Apply RGB Color Transform to First Three Bands" check box to specify that multispectral files whose first three bands are R,G and B (in that order) should have this transform run on them.
- Advanced MG4 preference options include two Alpha Source options, one to specify that all pixels are opaque and one to specify that the transparency or "nodata" value should be automatically detected from the image metadata.
- Advanced MG4 preference options include Dynamic Range Metadata Generation options. For more information on generating dynamic range metadata, see *Dynamic Range Metadata Generation* on page 125.
- Advanced MG3 preference options include radio buttons for selecting either the one-pass or two-pass optimizer.

The MrSID Generation 2 preferences mirror the settings found in the MG2 format-specific options on the **Advanced Job Options** dialog, with the exception that a default encode ratio can be specified for both color and grayscale images. When you add a new MrSID Generation 2 encode job, the encode settings will initially be set to the values declared in this tab.

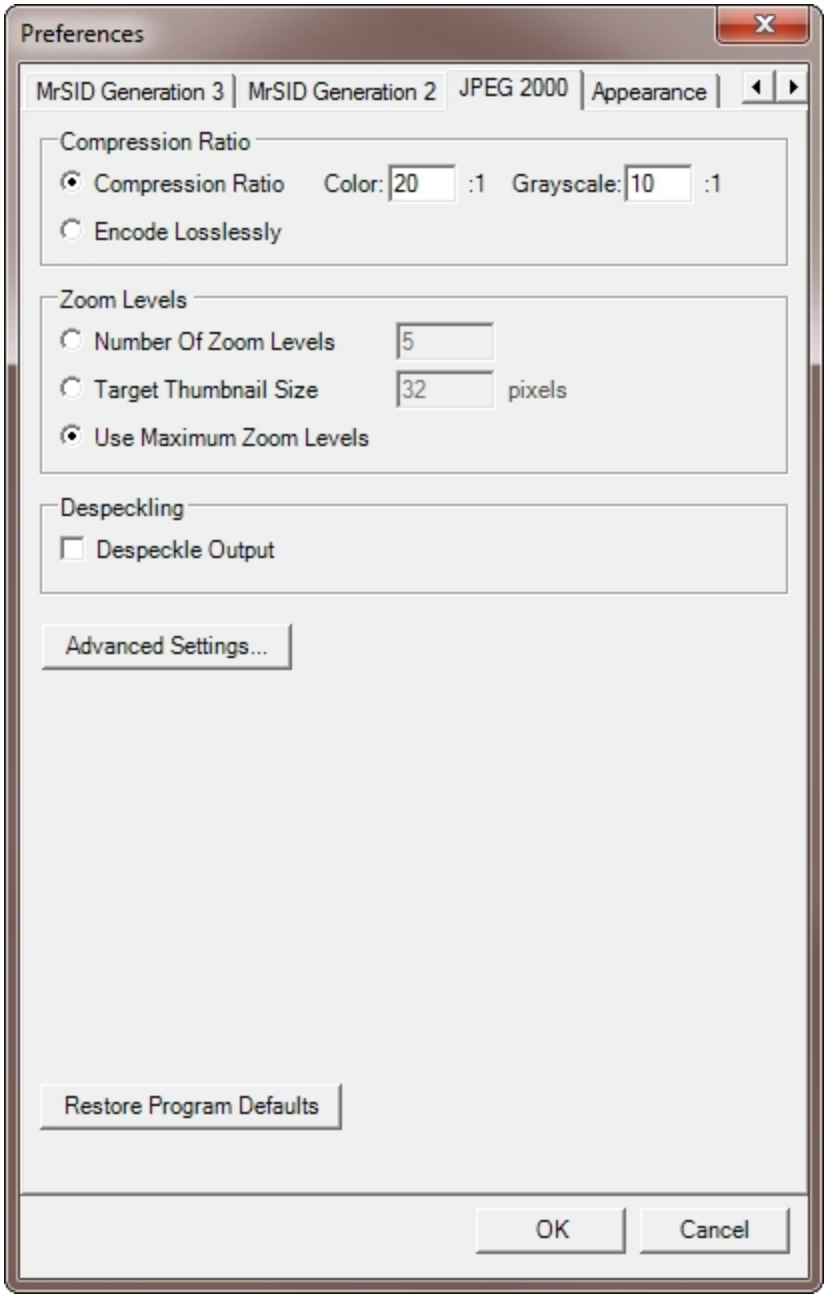


JPEG 2000 Preference Options

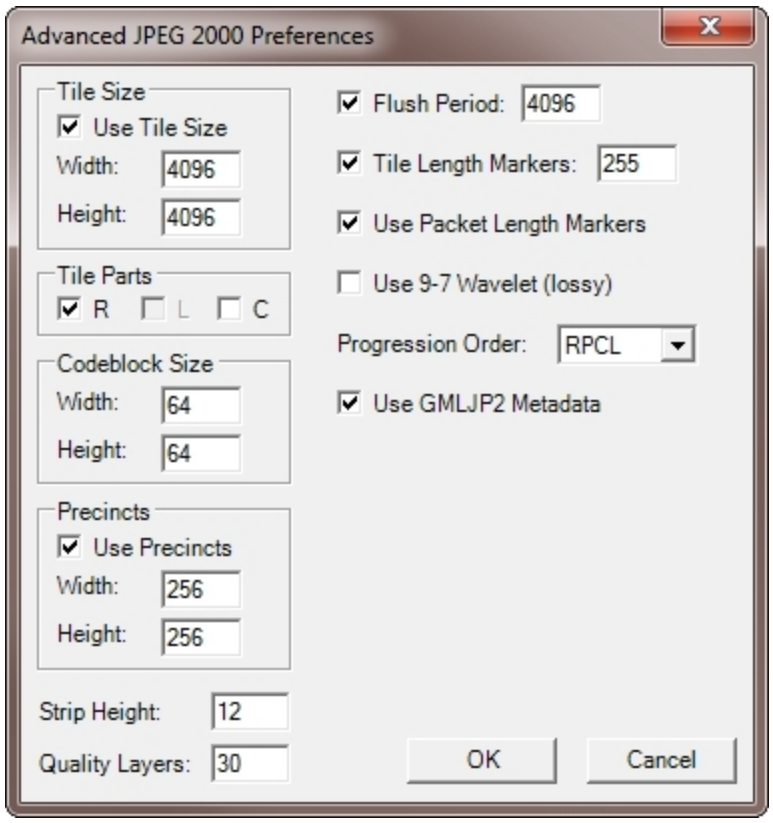
This page describes the preference options for JPEG 2000 preferences.

A drop-down list appears on the **General** tab of the **Preferences** dialog box enabling you to choose one of the JPEG 2000 modes as your default output file format.

The JPEG 2000 tab of the **Preferences** dialog box has a number of basic JPEG 2000 options, as shown below. These are the same options as those available for MrSID encoding. For more information on compression, see *Compression Overview* on page 39. For more information on zoom levels, see *Zoom Options* on page 108.



Click the **Advanced Settings...** button for further options, which are available on a separate dialog box, shown below.



The parameters set on the tab and dialog shown above determine the default options that appear in the **Advanced Job Options** dialog box, which includes all of these. Changes made on the **Advanced Job Options** dialog only affect the current job. To change the default settings, the parameters must be changed here.

For details about the advanced options see *Advanced JPEG 2000 Options* on page 133.

LiDAR Preferences

The **LiDAR Preferences** dialog box can be used to set the default preferences for LiDAR data, including compression options, text parsing options, and preview options.

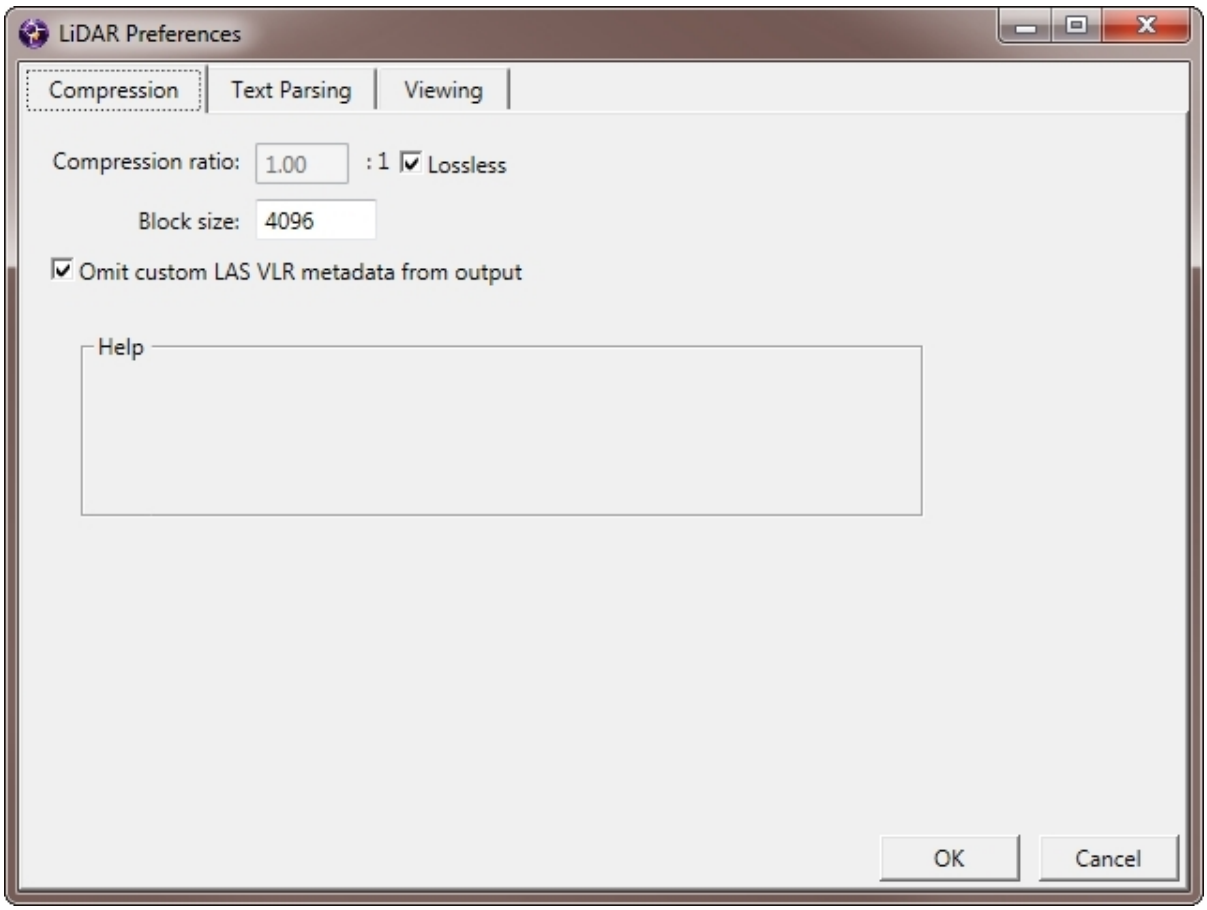
The **LiDAR Preferences** dialog box is divided into three tabs:

- Compression
- Text Parsing
- Viewing

Compression Preferences

Set general compression preferences for LiDAR data.

The following figure shows the compression preferences tab:



Compression Ratio

How much you want to compress the data. Depending on the compression ratio, the resulting file may have fewer points than the original point cloud. Alternatively, select the **Lossless** check box to create a compressed point cloud identical to the input point cloud.

Block Size

The number of points to process and store at one time. Enter a large block size to increase the compression speed. Enter a small block size to decrease memory usage. Valid values are from 2048 through 16384. The default value is 4096.

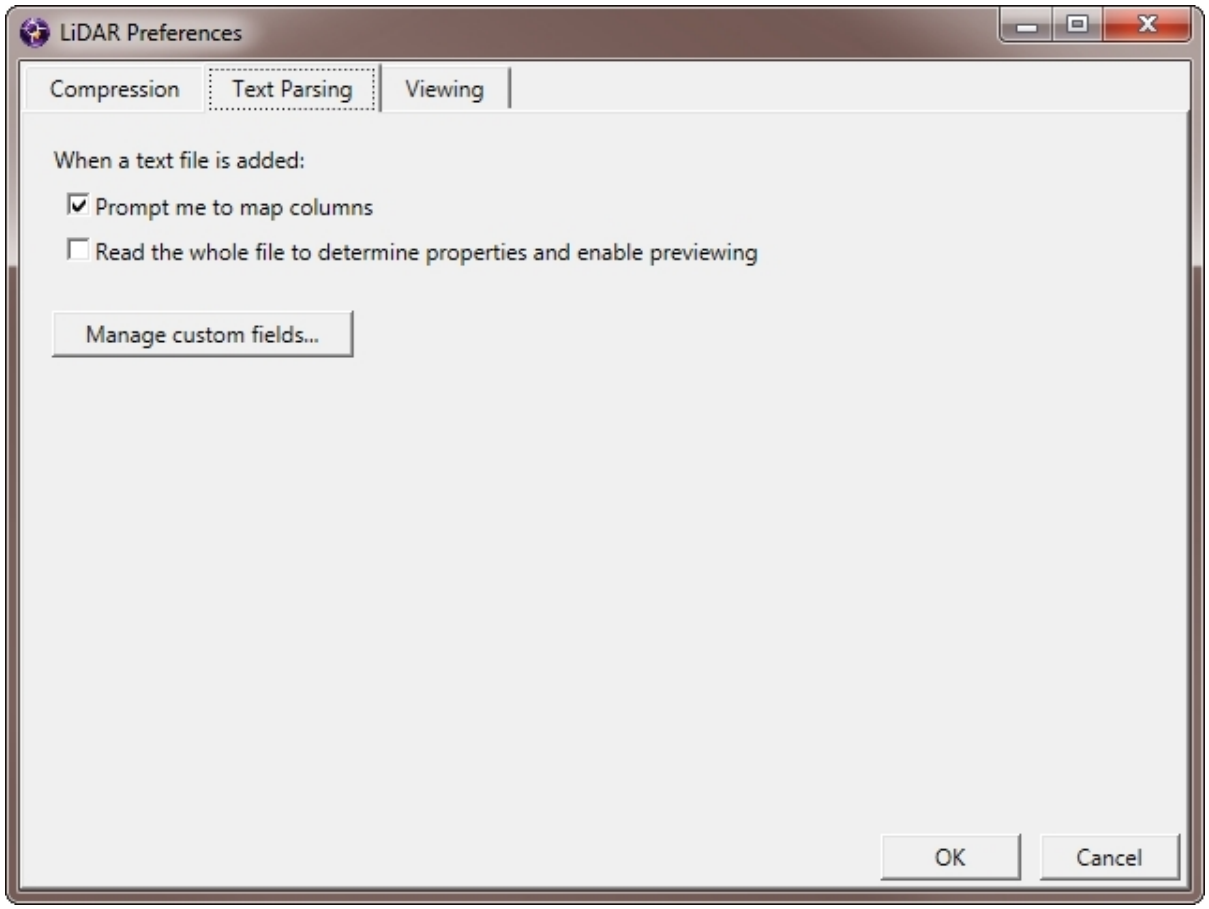
Omit Custom VLR Metadata

Omit custom variable length record (VLR) metadata from LAS files. VLR metadata can include vendor-specific data, user-specified data, and more.

Text Parsing Preferences

Set options for LiDAR point clouds stored as text files.

The following figure shows the text parsing preferences tab:



Map Columns

If you select this check box, GeoExpress displays a dialog that you can use to select columns from the input text file and map their values to standard fields like X, Y, Z, intensity, and more.

Read the Whole File

If you select this check box, GeoExpress reads all of the data in the input text file to determine properties like the point cloud extents and to enable previewing the file.

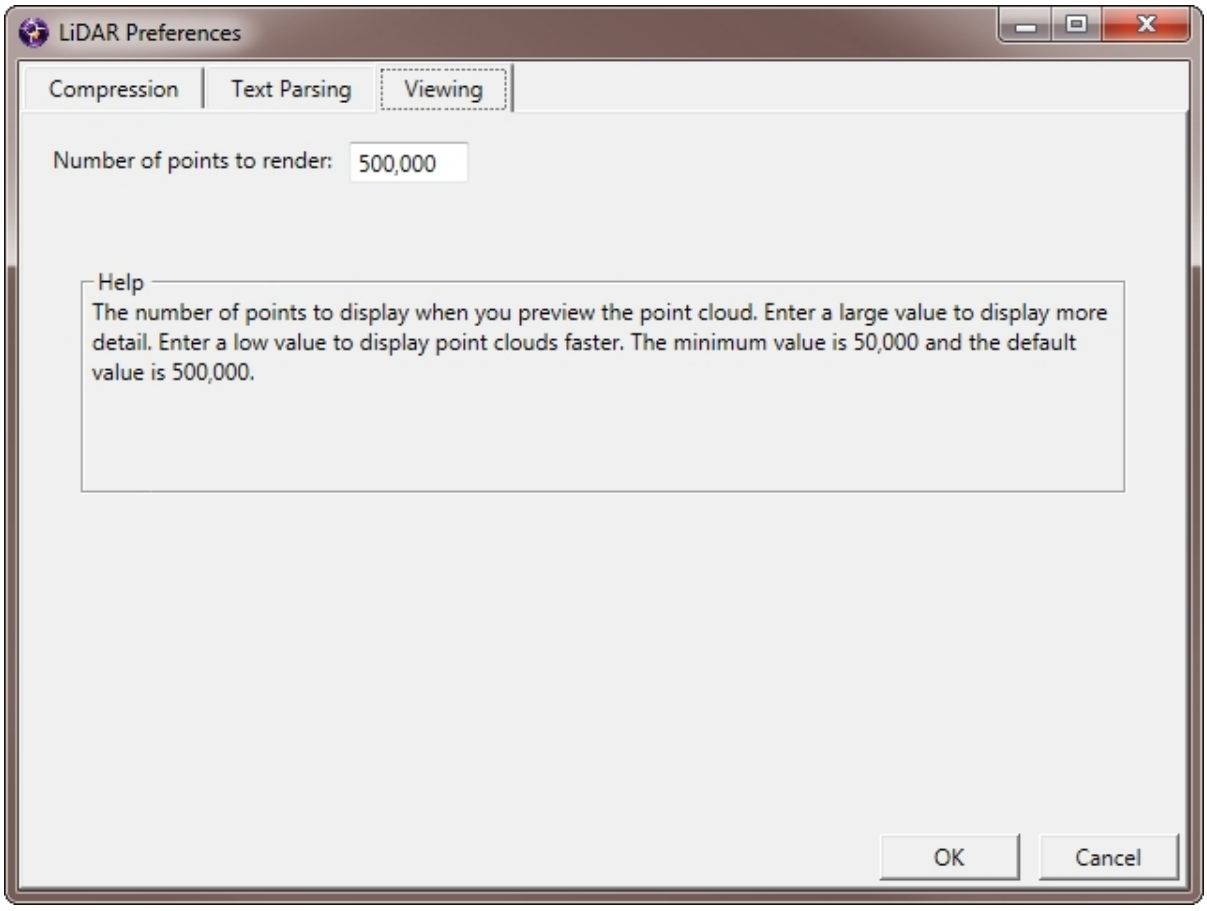
Manage Custom Fields

Click the **Manage Custom Fields** button to see the default fields available for LiDAR point clouds and to create custom fields. For example, you may want to create a custom field for a non-standard time format, for sensor information, and more.

Viewing Preferences

Set preferences for previewing LiDAR files.

The following figure shows the text parsing preferences tab:



Number of Points to Render

Enter the number of points to display when you preview the point cloud. Enter a large value to display more detail. Enter a low value to display point clouds faster. The minimum value is 50,000 and the default value is 500,000.

Viewing and Using Log Information

You can access log information for GeoExpress encoding and publishing operations in the log folder or directly from the GeoExpress graphical user interface (GUI).

Accessing Text Files in the Log Folder

By default, text files containing log records are located in "My Documents\LizardTech\GeoExpress\9\logs". You can change the location of the log files in the **Preferences** dialog.

The log folder contains separate logs for completed encoding and completed publishing jobs. If there are no log files in the folder, it means no encoding or publishing jobs have been performed.

Encoding jobs are recorded in the "`GeoExpress_log.txt`" and "`session_log.txt`" files. "`GeoExpress_log.txt`" is a persistent log that is appended with each encoding operation the user runs, whereas "`session_log.txt`" is a temporary log that lists only the images that were encoded in the current job. It is overwritten upon each new encoding operation.

Publishing jobs are recorded in the "`GeoExpressPublish_log.txt`" and "`publish_session_log.txt`" files. As with their encoding counterparts, "`GeoExpressPublish_log.txt`" is a persistent record of publishing operations that grows over time, while "`publish_session_log.txt`" records only the last completed publishing job.

Accessing and Using Session Records in the GUI

Viewing Encoding Results

A description of recently completed encoding projects can be viewed on the **Output** tab for a selected job.

1. Click the **Output** tab.

   The session log appears.

2. Use the scrollbar to locate information about a specific image.

> *TIP: If you select a job in the **Job List** while you view the **Output** tab, the session log only shows information about the selected job.*

Exporting the Session Log

Click the **Export Log** button to save the session log for a selected job. You can export the session log to a CSV or TXT file.

Viewing Results for a Publishing Operation

Upon completion of a publishing operation, the text window of the **Publish Images** dialog reports the results of the publishing operation. This is the same information logged in the "`GeoExpressPublish_log.txt`" and "`publish_session_log.txt`" files.

Copying Text from Log Entry

You may wish to copy information from the log entry and paste it elsewhere. Use the standard Windows copy (Ctrl+C) and paste (Ctrl+V) shortcuts on any text in the **Session Log** text box of the **Output** tab.

Printing the Session Log

You can print out the entire session log. This is the same information that is displayed on the **Output** tab.

To print the session log, do one of the following:

- Click **Ctrl + P** (Windows keyboard shortcut) when the **Output** tab is active.
- Select **Print Session Log** from the **File** menu.

Sample Log Entry

Following is an example of an output log entry. Details will be different depending on whether the output is to a file system or to an Express Server. This example is for an image encoded to a file system.

```
0       6/27/2013 2:30:01 PM    GeoExpress Session Log

GUI Version: 9.5.0.0.3774

Engine Version: 9.5.0.0.3774
```

```
Thursday, June 27, 2013 2:30 PM


Job ID  Time    Message Status

9       6/27/2013 6:07:37 PM    Job name: 48120g5g.tif (4 threads)

9       6/27/2013 6:07:37 PM    Operation: Encode image

9       6/27/2013  6:07:37  PM    Start  time:  Thursday,  June  27,
2013  6:07:37  PM

9       6/27/2013 6:07:37 PM    Input properties:

9       6/27/2013 6:07:37 PM         Input file name: \\SEA-DEV-IMAGE\Testim
ages\4bittiff\48120g5g.tif

9       6/27/2013 6:07:37 PM         Input file type: TIFF

9       6/27/2013  6:07:37  PM             Input  image  size:  17.9
MB  (18750000  bytes)

9       6/27/2013 6:07:43 PM

9       6/27/2013 6:07:43 PM    Output properties:

9       6/27/2013 6:07:43 PM         Output file name: \\SEA-DEV-IMAGE\Testi
mages\4bittiff\48120g5g.sid

9       6/27/2013  6:07:43  PM             Output  file  size:  917.4
KB  (939415  bytes)

9       6/27/2013 6:07:43 PM         Output file type: MrSID Generation 4

9       6/27/2013 6:07:43 PM         Encoder version: 9.5.0.0.3774

9       6/27/2013 6:07:43 PM         Target compression ratio: 20.00:1

9       6/27/2013 6:07:43 PM         Actual compression ratio: 19.96:1

9       6/27/2013 6:07:43 PM
```

```
9       6/27/2013  6:07:43  PM    Start  time:  Thursday,  June  27,
2013  6:07:37  PM

9       6/27/2013  6:07:43  PM    Finish  time:  Thursday,  June  27,
2013  6:07:43  PM

9       6/27/2013 6:07:43 PM    Total time: 5 seconds   Succeeded

9       6/27/2013 6:07:43 PM
```

Chapter 12: Other Operations

Other Operations Overview

In addition to image compression and manipulation operations you can perform the following operations:

- Publish images to an Express Server.
- Use world files to specify georeferencing information for images or generate world files for your images.
- Generate Esri AUX files for your images.

Publishing Existing Images

You can use GeoExpress to publish images directly to Express Server. Express Server supports MG4, MG3, MG2, and JPEG 2000 images. Publishing is a one-time operation that does not use project files and does not alter or delete the source images on the machine's hard disk.

To publish existing images:

1. In the **Tools** menu, click **Publish Images.**

   The **Publish Images** dialog box appears.

2. Add images to the **Source Images** list by clicking **Add Images To Publish**, selecting images, and clicking **Open**. Alternatively, drag files into the window.

3. When you finish adding images, click **Publish to Express Server**.

   The **Express Server** browser appears. For more information, see *Selecting an Express Server* on page 92.

4. Click **OK** to begin the publishing process.

The **Publish Image** dialog changes to display two progress bars. The bottom bar monitors the publishing progress of an individual image and the top bar monitors the aggregate progress of all the images in a job.

To cancel the operation, click either **Cancel All** or **Cancel Current Image**.

Viewing Results

The results of a publishing operation are displayed in the Publishing dialog. Alternatively, you can view the results by opening the log files stored in the following directory:

```
<User directory>\Documents\LizardTech\GeoExpress\9\logs
```

There are two log files related to publishing:

- `GeoExpressPublish_log.txt` is a running log of all publishing operations.
- `publish_session_log.txt` is a temporary log that only lists the images published in the most recent publishing operation.

For more information see *Viewing and Using Log Information* on page 177.

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".

Generating World Files

A check box can be selected on the **General** tab of the **Preferences** dialog box to automatically generate world files upon encoding.

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 whitespace 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.

Using World Files

Once you have added imagery to the Job list, you should check its extents on the Properties tab to make sure it has the proper positioning. If it does not, check for the presence of world files in the source directory. If there are world files, you can instruct GeoExpress to use them.

To specify that world files should be used:

1. Select an image in the **Job List** and click the **Advanced** button on the **Properties** tab.

   The **Advanced Job Options** dialog box appears.

2. Select the **Input** tab.
3. Select the **Use World Files** check box.
4. Click **OK**.

IMPORTANT: Use of world files removes the CRS or other georeferencing information from the image.

TIP: If no world file exists or if using world files does not result in correct positioning, you can change the image extents by editing the image metadata. For more information see Editing Raster Metadata on page 46.

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:

1. Select **Preferences...** from the **Options** menu. The Preferences dialog box opens.
2. Select the **Generate Esri AUX Files** check box in the World File Support group of options.
3. Make any other changes to Preferences and click **OK**.

AUX files will now be generated upon encode and output to the same folder as the output images.

To stop generating Esri AUX files, clear this check box.

By default Esri AUX files are not generated.

Chapter 13: JPEG 2000 Images

JPEG 2000 Images Overview

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).

All of the basic 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.

JPEG 2000 Output Selections

GeoExpress supports encoding JPEG 2000 files in two different modes,"GMLJP2" and "Part I". By default GeoExpress uses GMLJP2, which 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 two modes are included as options in the Output Format drop-down list. For convenience when creating mosaics, this drop-down list also appears on the “Create New Mosaic” dialog box.

JPEG 2000 encoding utilizes the same data cartridge deduction mechanism that MrSID encoding does (see *Frequently Asked Questions* on page 226 and *Data Cartridges* on page 217). Operations involving only MrSID and/or JPEG 2000 input files do not decrement the cartridge.

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 JPEG 2000 Output Selections on page 185.*

The GML option is available among the metadata control settings of the advanced JPEG 2000 options (see *GMLJP2 Metadata* on page 139).

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/.

JPEG 2000 and Color Spaces

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. 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 188.

Encoding with Alpha Bands in JPEG 2000

JPEG 2000 supports the use of an alpha band or "alpha 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.

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.

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.

Creating Multiband JPEG 2000 Files

GeoExpress allows the creation of multiband JPEG 2000 files from a collection of single-band grayscale image files. The input files must all have the same dimensions, resolution, bit depth, and geographic positioning. Empty bands are allowed, and treated as zero data.

1. Select **Add color composite image to encode...** from the **File** menu.

   The **Add Color Composite Image** dialog box appears.

2. Select a color space for the image from the drop-down menu, either **RGB** or **Multispectral**. RGB populates the list box with editable red, green, and blue bands. Multispectral populates the list box with bands that range from 1 to n. You can change the number of bands in a multispectral image by clicking **Edit number of bands...** and typing in a new value.

3. To add an image file to a band, select the desired band and then click **Edit file name...**. The Edit File Name dialog box appears as shown below.

4. Type in a file name or click **Browse...** to bring up a file browser. If you want to remove a file from a given band, simply clear the text from the file name field. A color composite image must have at least one band specified.

For information on NITF image segments in color composite images, see *Using a NITF Image Segment as a Component Band in a Color Composite Image* on page 191.

Chapter 14: NITF Images

NITF Images Overview

Creating NITF images requires a NITF license. This chapter offers information about how 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.

The NITF format requires information is entered on numerous metadata fields on several forms. For NITF JPEG 2000 encoding, you can edit the metadata fields – as well as the LizardTech metadata tags – in the Metadata Manager.

For details about how GeoExpress saves NITF metadata, see *NITF Metadata* on page 55.

> *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 Requirements 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.

NITF Output Selections

You may select NITF 2.1 as an output format from the Output Format drop-down list, which appears in two places:

- on the **Properties** tab
- on the **Create New Mosaic** dialog box

Two different types of NITF encoding are available: raw (uncompressed) and JPEG 2000.

Raw NITF

Because raw files are uncompressed, when NITF 2.1 (Raw) is selected as the output format encode ratio, target file size and other options become unavailable, and the **Format-Specific** tab of the **Advanced Job Options** dialog box is absent. Metadata editing is not supported for raw NITF encoding.

JPEG 2000 NITF

When NITF 2.1 (JPEG 2000) is selected as the output format, the source imagery is encoded to JPEG 2000. Thus, when JPEG 2000 is selected, all of the JPEG 2000 encoding options become available. The options common to MrSID formats reappear on the **Properties** tab . These and all of the options specific to JPEG 2000 become available on the **Format-Specific** tab of the

Advanced Job Options dialog box. For more information about these options, see *Advanced JPEG 2000 Options* on page 133.

Setting NITF as the Default Output Format

You may specify NITF 2.1 as your default output format by selecting it from a drop-down list on the General tab of the Preferences dialog box. For more information, see *Setting Preferences* on page 159.

Multisegment NITF Images

Using Multisegment NITF Files as Input

To be valid, the image segments comprising an incoming NITF file must be mosaickable. They must have compatible resolutions, colorspaces, and datatypes, and must all fall on the same coordinate space.

To view the image segments in a multisegment NITF image, right-click on the job in the **Job List** and select **NITF Image Segments**. The segments can be removed from the output image by clearing the check boxes beside each image segment.

If no segments are selected, the input image is considered invalid.

When the image is encoded, the selected segments are mosaicked into a single flat image.

NITF mosaic tiles behave the same way as other image tiles in the encoding process; the selected segments of each tile are mosaicked together first, and then the tiles are mosaicked together for the final output.

Using a NITF Image Segment as a Component Band in a Color Composite Image

To use a multisegment NITF file as a component band in a color composite image:

1. Click the **File** menu and select **Add color composite image to encode**.

   The **Add Color Composite Image** dialog box appears.

2. Select **RGB** or **Multispectral** from the **Color Space** drop-down list at upper right.

3. Select a band and click **Edit File Name...**.

The **Edit File Name** dialog box appears.

4. Enter a file name or click **Browse...** to locate the file, then click **OK**. If the file you selected is a multiple image segment NITF file, a third dialog box (the **Image Segment Selector** dialog box) appears.
5. Select which 1-banded image segment of the selected NITF file you wish to use as the "active segment" for the selected band, then click **OK**.

Changing the Active Segment in a Color Composite Image

You can change the active segment in a color composite image at any time.

To change the active segment:

1. Click the **File** menu and select **Add color composite image to encode**.

   The **Add Color Composite Image** dialog box appears.

2. Click **Select Image Segment...**.

   The **Image Segment Selector** dialog box appears.

3. Select a different 1-banded image segment from the drop-down list and click **OK**.

Creating Multisegment NITF Files

To create a NITF file with multiple image segments, the individual segments must be mosaickable. This is because they must be placed on a common grid. All of the mosaicking rules for other kinds of images apply to multisegment NITF images. For more information on mosaics, *Mosaics* on page 143.

To create a multisegment NITF file:

1. Click the **Create New Mosaic** button  on the toolbar.

   The **Create New Mosaic** dialog box appears.

2. Select **NITF** as the output format.
3. Select the **Create multiple image segments** radio button.

NOTE: Multisegment NITF encoding supports up to 999 image segments. If you attempt to encode more than 999 tiles as a multisegment NITF file, an error message informs you that you have exceeded the maximum number of image segments and asks whether or not you would like to flatten the input tiles first. Clicking "Yes" will result in a single image segment NITF file. This is equivalent to clearing the "Create multiple image segments" check box. Clicking "No" simply cancels the addition of that tile.

Appendix A - Technical Information

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

Estimated Memory Usage Display

The **Estimated Memory Usage** value is displayed on the **Properties** tab except when the output format is other than MrSID or the 1-pass optimizer is used. GeoExpress uses the 2-pass optimizer by default.

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 on the **Format-Specific** tab of the **Advanced Job Options** dialog box. For more information on block size, see *Block Size* on page 129.
- `MIN(StripHeight, BlockSize)` evaluates the values for the strip height and block size and equals whichever value is smaller.
- `StripHeight` is set by the user on the **Format-Specific** tab of the **Advanced Job Options** dialog box. For more information on strip height, see *Strip Height* on page 129.
- `NumBands` is the number of bands in the image to be encoded – typically 1 or 3 (This value is noted in the **Properties** tab.)
- `Width` is the width of the input image in pixels. (This value is noted in the **Properties** tab.)

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 x BlockSize + 64) x NumBands x Width x 4) + (
0.005 x ExpectedOutputFileSize )
```

- `Memory` is the estimated memory usage in bytes.
- `BlockSize` is set by the user on **Format-Specific**tab of the **Advanced Job Options** dialog box. For more information on block size, see *Block Size for MG2* on page 132.
- `NumBands` is the number of bands in the image to be encoded – typically 1 or 3 (This value is noted in the **Properties** tab.)
- `Width` is the width of the input image in pixels. (This value is noted in the **Properties** tab.)
- `ExpectedOutputFileSize` is the target file size. (This value is noted in the **Properties** tab.)

How Mosaic Sizes are Calculated

The size of a mosaic is calculated from the nominal size of the output mosaic. For raster images, the nominal size is the product of the image width, the image height, the number of bands, and the number of bytes per band. Also for raster images, the nominal size assumes that all portions of the image include valid data, whether or not this is this the case. 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

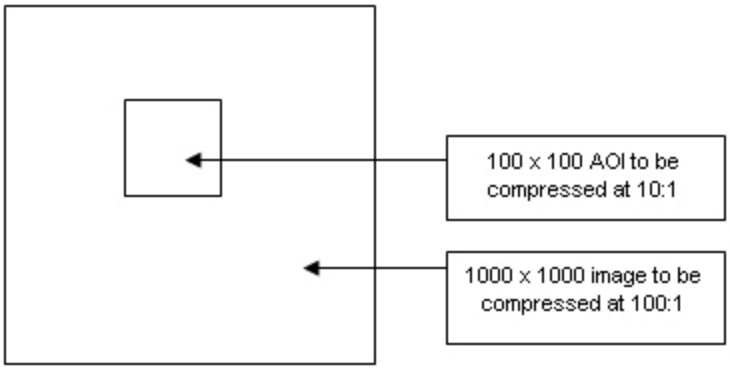
In these cases, the transparency regions in the output image are included in the mosaic size. Also in these cases, the estimated output file size may be considerably larger than the actual output file size.

> *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 radio button enables you to specify an encode ratio for the area of interest or select the Lossless check box. 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 x 1000 pixels. The user specifies compression for this image at 100:1. An area of interest measuring 100 x 100 pixels is then defined within the image, and the compression ratio inside the area of interest is set at 10:1.



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 x 1000 pixels = 1,000,000 pixels

Area of the AOI ($Area_{AOI}$) is 100 x 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 (FStotal) = 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: This calculated filesize appears on the Properties panel for the image once you close the Area of Interest dialog box. The actual output is reported in the GeoExpress

log file on the Output tab of the Properties panel (see Viewing and Using Log Information on page 177).

Header Files for BIP, BIL and BSQ Images

A BBB image consists of two files, a binary file containing only the raw sample values of the image and a text file describing the image properties. The raw data may be organized in one of three layouts: "band-interleaved by pixel" (BIP), "band-interleaved by line" (BIL), and "band sequential" (BSQ). The three formats are collectively referred to as the BBB file format.

Because BBB files only contain raw data with an easily editable header format, they are often used as a "least common denominator" interchange format. However, there is no set standard for the keywords that may be contained in the header. This document describes the header format that GeoExpress supports.

GeoExpress recognizes four filename extensions: ".bip", ".bil", ".bsq", and ".bbb". The first three imply the layout is BIP, BIL, or BSQ respectively; the ".bbb" extension implies the default layout, which is BIP. The header file for a BBB image has the same name as the image, but with a ".hdr" extension.

Header Syntax

The header file is a simple text file containing keywords and their associated value, one keyword/-value(s) set per line. All keywords and values are case-insensitive. Blank lines are ignored. Leading and trailing whitespace is ignored. A line that begins with a '#' character, possibly preceded by whitespace, indicates a comment line. Comment lines are ignored.

Supported Keywords

The keywords and their allowed values are as follows:

Keyword	Description	Notes
BANDGAPBYTES		Corresponding metadata tags are created, but the actual values are not used in setting the geocoordinates of the input image

Keyword	Description	Notes
BANDROWBYTES		Corresponding metadata tags are created, but the actual values are not used in setting the geocoordinates of the input image
BANDS	Same as NBANDS	
BYTE_ORDER	Endianness interpretation of data	Allowed values: MOTOROLA, M, BIG, BIGENDIAN, NA The value NA may only be used if the number of bands is 1 Default: host endianness
BYTEORDER	Same as BYTE_ORDER	
COLORSPACE	The colorspace of the image	Allowed values: GREY, GREYA, GRAY, GRAYA, GREYSCALE, GREYSCALEA, GRAYSCALE, GRAYSCALEA, RGB, RGBA, CMYK, CMYKA, MULTISPECTRAL, MULTISPECTRALA Default: GRAY for 1-banded images, RGB for 3-banded images, otherwise MULTISPECTRAL
COLS	Same as NCOLS	
DATATYPE	The data type of the samples	Allowed values: U8, U16, S8, S16, F32 Default: U8
DYNAMICRANGELEVEL	The midpoint of the range of the data	Allowed values: a single floating-point value (applies to all bands) Default: (none)
DYNAMICRANGEMAX	The maximum dynamic range	Allowed values: a single floating-point value (applies to all bands) Default: (none)
DYNAMICRANGEMIN	The minimum dynamic range	Allowed values: a single floating-point value (applies to all bands) Default: (none)
DYNAMICRANGEWINDOW	The size of the range of	Allowed values: a single floating-point value

Keyword	Description	Notes
	the data	(applies to all bands) Default: (none)
E_SQUARED	Sphere eccentricity squared, for georeferencing	Corresponding metadata tags are created, but the actual values are not used in setting the geocoordinates of the input image
INTERLEAVING	Same as LAYOUT	
LAYOUT	The data layout; use of this keyword overrides the layout implied by the filename extension	Allowed values: `BIP`, `BIL`, `BSQ`, or `NA` The value `NA` may only be used if the number of bands is 1 Default: `BIP`
MAP_UNITS	Measurement unit for georeferencing	Corresponding metadata tags are created, but the actual values are not used in setting the geocoordinates of the input image
NBANDS	The number of bands in the image	Allowed values: 1-65535 Default: (none; this keyword is required)
NBITS	Number of bits used per sample	Allowed values: 1 to (total number of bits per sample) Default: the total number of bits per sample
NCOLS	Width of image, in pixels	Allowed values: 1 to 2^31 Default: (none; this keyword is required)
NROWS	Height of image, in pixels	Allowed values: 1 to 2^31 Default: (none; this keyword is required)
PIXEL_HEIGHT	Same as YDIM	
PIXEL_WIDTH	Same as XDIM	
PROJECTION_NAME	Name of projection system, for georeferencing	Corresponding metadata tags are created, but the actual values are not used in setting the geocoordinates of the input image
PROJECTION_ PARAMETERS	Numeric projection parameters, for geor-	Corresponding metadata tags are created, but the actual values are not used in setting

Keyword	Description	Notes
	eferencing	the geocoordinates of the input image
PROJECTION_ZONE	Projection zone number, for georeferencing	Corresponding metadata tags are created, but the actual values are not used in setting the geocoordinates of the input image
RADIUS	Sphere radius, for georeferencing	Corresponding metadata tags are created, but the actual values are not used in setting the geocoords of the input image
ROWS	Same as NROWS	
SEMI_MAJOR_AXIS	Semimajor axis, for georeferencing	Corresponding metadata tags are created, but the actual values are not used in setting the geocoords of the input image
SEMI_MINOR_AXIS	Semiminor axis, for georeferencing	Corresponding metadata tags are created, but the actual values are not used in setting the geocoords of the input image
SKIPBYTES	Number of bytes at top of image file to skip	Allowed values: 0 to (image size in bytes) Default: 0 This can be used for raw formats which contain a fixed number of "header" bytes at the top of the data file
SPHEROID_NAME	Name of projection system, for georeferencing	Corresponding metadata tags are created, but the actual values are not used in setting the geocoordinates of the input image
TOTALROWBYTES		Not currently supported – value is ignored
UL_X_COORDINATE	Same as ULXMAP	
UL_Y_COORDINATE	Same as ULYMAP	
ULXMAP	Upper-left *x*-position, for georeferencing	Allowed values: (any floating point value) Default: (none)
ULYMAP	Upper-left *y*-position, for georeferencing	Allowed values: (any floating point value) Default: (none)

Keyword	Description	Notes
WORDLENGTH	Number of bytes per sample	Allowed values: 1 or 2 Default: 1, unless overridden by DATATYPE
XDIM	Size of pixel in *x*-direction, for georeferencing	Allowed values: (any floating point value) Default: (none)
YDIM	Size of pixel in *y*-direction, for georeferencing	Allowed values: (any floating point value) Default: (none) **NOTE:** this is expected to be a positive value

Additional Notes

These keywords are required: `NBANDS`, `NCOLS`, `NROWS`. All other keywords have default values.

If dynamic range is used, either both `DYNAMICRANGEMIN` and `DYNAMICRANGEMAX` must be set or both `DYNAMICRANGEWINDOW` and `DYNAMICRANGELEVEL` must be set.

Example

This BBB header file describes a 640x480 RGB color image, using 16 unsigned bits per sample.

NROWS 480

NCOLS 640

NBANDS 3

DATATYPE U16

Extensions

Note that some of the header syntax supported by GeoExpress may not be supported by other vendors' BIP/BIL/BSQ implementations. In particular, the following features and keywords may be somewhat specific to LizardTech:

- interpretation of .bbb extension as meaning layout of BIP
- support for comment lines
- the `COLORSPACE` keyword

- the DYNAMICRANGEMIN, DYNAMICRANGEMAX, DYNAMICRANGEWINDOW, and DYNAMICRANGELEVEL keywords

Header Files for USGS DOQ Images

GeoExpress reads and maintains accurate georeferencing for images in USGS DOQ format. DOQ files contain metadata information in an ASCII header file contained within the file.

GeoExpress can read images in both old and new DOQ header formats. The less common “exponential” DOQ header format is not supported.

Example

The following is an example of the current standard USGS DOQ header format:

```
BEGIN_ USGS_ DOQ_ HEADER *

QUADRANGLE_ NAME “QUINCY WEST” 3.75 or 7.5-min. name*

QUADRANT NE quadrant indicator if cell size = 3.75minutes*

WEST_ LONGITUDE -91 26 15.000 signed deg., min. &amp; sec.*

EAST_ LONGITUDE -91 22 30.000 signed deg., min. &amp; sec.*

NORTH_ LATITUDE 40 0 0.000 signed deg., min. &amp; sec.*

SOUTH_ LATITUDE 39 56 15.000 signed deg., min. &amp; sec.*

PRODUCTION_ DATE 1995 07 13 yyyy mm dd*

RASTER_ ORDER LEFT_ RIGHT/TOP_ BOTTOM video display order*

BAND_ ORGANIZATION SINGLE FILE single file or BSQ, or BIL or BIP*

BAND_ CONTENT BLACK&amp; WHITE black&amp; white or red green blue*

BITS_ PER_ PIXEL 8 *

SAMPLES_ AND_ LINES 6076 7641 number of columns and rows*

HORIZONTAL_ DATUM NAD83 primary horizontal datum*

HORIZONTAL_ COORDINATE_ SYSTEM UTM *
```

```
COORDINATE_ ZONE 15 coordinate system zone number*

HORIZONTAL_ UNITS METERS coordinate system units*

HORIZONTAL_ RESOLUTION 1.0 coordinate system geometric resolu. in h
oriz. units*

SECONDARY_ HORIZONTAL_ DATUM NAD27 secondary horizontal datum*

XY_ ORIGIN 633063.000 4429328.000 coord.of upper left pixel-pr
i. datum*

SECONDARY_ XY_ ORIGIN 633079.000 4429113.000 coor.-upper left pixe
l-sec datum*

NATION USnation code*

STATE IL state fips codes*

STATE MO state fips codes*

NW_ QUAD_ CORNER_ XY 633377.438 4428926.385 X-Y coords. of pri. NW
quad corner*

NE_ QUAD_ CORNER_ XY 638712.782 4429021.805 X-Y coords. of pri. NE
quad corner*

SE_ QUAD_ CORNER_ XY 638839.205 4422084.460 X-Y coords. of pri. SE
quad corner*

SW_ QUAD_ CORNER_ XY 633498.995 4421989.077 X-Y coords. of pri. SW
quad corner*

SECONDARY_ NW_ QUAD_ XY 633380.942 4428716.377 X-Y coords. -sec. NW
quad cor.*

SECONDARY_ NE_ QUAD_ XY 638716.426 4428811.800 X-Y coords. -sec. NE
quad cor.*

SECONDARY_ SE_ QUAD_ XY 638842.847 4421874.579 X-Y coords. -sec. SE
quad cor.*
```

```
SECONDARY_ SW_ QUAD_ XY 633502.497 4421779.193 X-Y coords. -sec. SW
quad cor.*

RMSE_ XY 0.82 doq horiz.accuracy*

IMAGE_ SOURCE ìblack &amp; white film b&amp; w, color, infrared or
other*

SOURCE_ IMAGE_ ID NAPP 2231-2" source image identification*

SOURCE_ IMAGE_ DATE 1991 03 24 source image date as yyyy mm dd*

SOURCE_ DEM_ DATE 1995 07 00 source DEM date*

AGENCY WesternMappingCenter (WMC) name of oversight agency*

PRODUCER WesternMappingCenter (WMC) name of DOQ producer*

PRODUCTION_ SYSTEM ìDV1.2 03/ 93 OV1.1 04/ 93” name of the producti
on HW &amp; SW*

STANDARD_ VERSION 1996 12 version of DOQ standard*

METADATA_ DATE 1996 7 13 date created or changed, yyyy mm dd*

DATA_ FILE_ SIZE 46432792 data set size in bytes*

BYTE_ COUNT 6076 header byte count*

*

*

END_ USGS_ HEADER *
```

Supported TIFF Compression Types

The Properties tab in the GeoExpress interface 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.

TIFF Compression Types and Support in GeoExpress

Compression	Supported?
CCITT Group 3 fax	No
CCITT Group 4 fax	No[1]
Limpel-Ziv-Welsh (LZW)	Yes
Old JPEG	No
Standard JPEG, including 12-bit	Yes
NeXT run-length	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; Zon
e 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["Green-
          wich",0],UNIT["degree
          (supplier to define representation)
          ",0.01745329251994328]
          ,AUTHORITY["EPSG","4269"]],PROJECTION["Trans-
          verse_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 - Cartridges and Floating Licenses

Data Cartridges

If you have a copy of GeoExpress Standard Edition, you may need to install a data cartridge before being able to encode images.

To install cartridges, visit https://www.lizardtech.com/support/product-activation/. To order additional cartridges, contact your LizardTech sales representative.

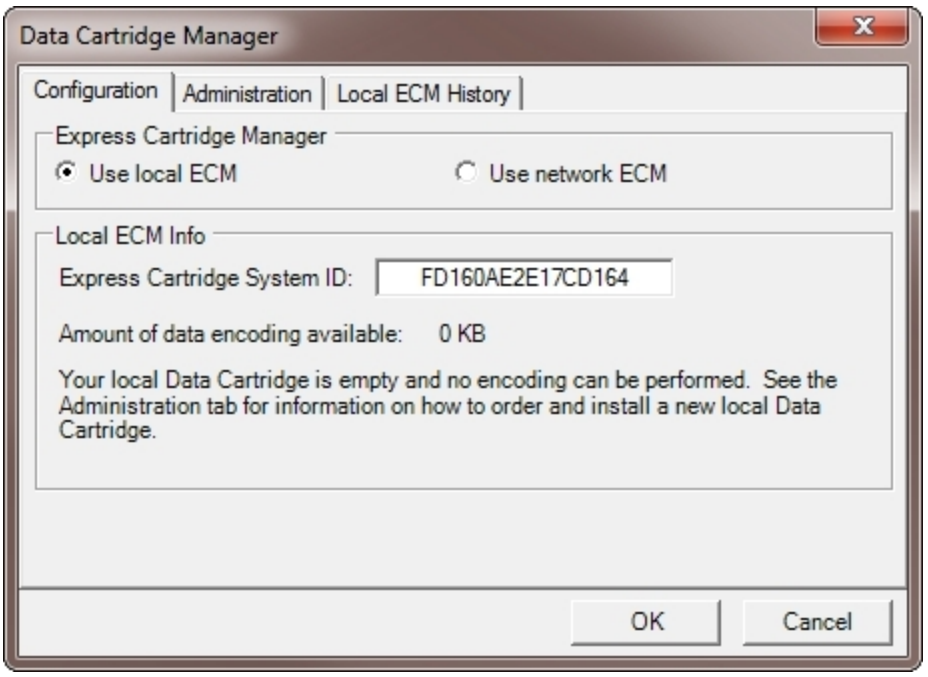
The information below tells you how to access and use the Data Cartridge Manager and how to calculate cartridge usage.

For more information see *Installing Data Cartridges* on page 11 and *Data Cartridge Gauge* on page 16.

Data Cartridge Manager

The Data Cartridge Manager has tabs for configuration, administration, and history of the Express Cartridge Manager (ECM) as shown below.

To access the **Data Cartridge Manager** select **Data Cartridge** from the **Tools** menu.



Configuration

The Configuration tab shows which ECM system is currently active, either a local ECM or a network ECM. You must have a local ECM installed to run GeoExpress in case a network ECM is unavailable. The configuration tab also shows the amount of units remaining in the active data cartridge. If "local ECM" is selected, the tab also displays the system ID for the local ECM. If "network ECM" is selected, the host name and port ID of the network ECM are displayed, which you can change by clicking the “Select a network ECM...” button. A valid host name and port ID must be supplied for a network ECM, and the application won't accept the specified network ECM until it initializes it successfully.

Administration

The Administration tab displays instructions for ordering and installing a new local data cartridge and has a button for selecting a local data cartridge to install.

History

The History tab loads and displays the transaction log file for the local ECM. It only gets loaded once during the lifetime of the Data Cartridge Manager, so the dialog must be dismissed and opened again to refresh the history information.

Calculating Usage

The number of megabytes deducted for a job is approximately equal to the nominal size of the image or point cloud. For raster images, you can calculate the nominal size with the following equation:

```
width x height x number of bands x bytes per band
```

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.

For mosaics, the cost is calculated from the sum of the nominal sizes of the input tiles rather than from the nominal size of the resulting mosaic. This means that in cases where a mosaic of non-contiguous images is created you are not charged for the areas without tiles.

> *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.*

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.

The LizardTech License Server runs as a service named `LizardTech License Server`.

Server Installation, Setup and Options

Installing the LizardTech License Server

The License Server is installed from the GeoExpress installation DVD. You must have admin rights to install the License Server.

To install the LizardTech License Server:

1. Insert the GeoExpress DVD in the DVD drive. The DVD browser screen appears. (**Note:** If the DVD browser does not appear, double-click the `autorun.HTA` file found on the DVD)
2. Select **License Server w/Tools and Documentation**, then follow instructions until

finished. By default, the product is installed in "C:\Program Files\LizardTech\License Server".

The installation creates the `LizardTech License Server` service.

Setup

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.

Adding Licenses

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

To add a license for a License Server on Windows or Linux:

1. Run the `echoid.exe` file to display your locking code. On Windows this file is located by default in "C:\Program Files\ LizardTech\License Server\bin". On Linux it is in "/usr/local/LizardTech/LicenseServer/". Record this value.
2. Copy your locking code, then use a Web browser to navigate to the following URL:

   www.lizardtech.com/support/activation/.
3. Enter and submit your locking code. You will receive your unlocking code within 24 hours.
4. When you receive your unlocking code, run the **`lslic.exe`** file in the same Tools directory by one of the following methods:
   a. Open a command line interface and enter `lslic.exe -A <Unlocking Code>` (where Unlocking Code is the code given to you by LizardTech)
   b. Select **Run** from your **Start** menu. In the Open field of the Run dialog box, enter `lslic.exe -A <Unlocking Code>` (where Unlocking Code is the code given to you by LizardTech).

Alternatively, you can manually add the locking code to following 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.

Setting License Server Options

In most cases, you will not be aware of the floating license leasing process because it will occur invisibly and automatically. In these cases, the user need only install the LizardTech License Server. However, there are situations where the end-user will have to adjust their settings to ensure that they are using the correct license, as for example when a client machine has access to both a standalone and a NITF-enabled network version of the same license, or if there are two different versions of a license on the license server and the user would prefer one over the other (i.e. NITF-enabled versus non-NITF-enabled). In these cases, GeoExpress by default prefers the non-NITF version if one is available. To change this you must set your licensing options so that preference is given to the NITF-enabled license.

To specify a preferred License Server:

1. Select **Licensing** from the **Options** menu.

   The License Management dialog box appears.

2. Enter a license server and click **OK**.
3. Optionally, to specify a preference for a NITF-enabled license, select the **Prefer NITF License** check box.

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.*

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 box.*

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.

License Server Utilities

Utility	Platform	Description
echoid	All	Generates a locking code
lserv	Unix only	Starts the server (must have admin rights)
lservnt	NT only	Starts/stops the server (see the SentinelLM System Administrator's Online Guide for parameters)
loadls	NT only	Loads the License Server service into NT services
WlmAdmin.exe	Windows only	Displays a list of servers/licenses
lsrvdown	All	Stops the server (must have admin 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 *Setting License Server Options* on page 221 above).

> *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.

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.

Commuter License Checkout Utilities

On this platform...	Use this utililty...
win32	LizardTech's Commuter Licensing utility or `ltcommute.exe`
win64	LizardTech's Commuter Licensing utility or `ltcommute.exe`
Linux	`lcommute`

LizardTech's Commuter Licensing Utility

Use the Commuter Licensing utility for win32 and w64 platforms as an alternative to `lcommute` or `ltcommute`. The Commuter Licensing utility uses the executable `wcommute.exe`.

To check out a license using LizardTech's Commuter Licensing utility:

1. On the **Start** menu select **Programs > LizardTech > GeoExpress > Commuter Licensing**.

   Alternatively, run the executable `wcommute.exe`. The **Commuter Licensing** dialog appears.

2. Click **Single Server...** and specify a server name, then click **OK**. Alternatively, click **Search Subnet**. Available licenses are displayed.
3. Select a license and click **Check Out**. The license is now marked with a red check.

To check a license back in using the Commuter Licensing utility:

1. On the **Start** menu select **Programs > LizardTech > GeoExpress > Commuter Licensing**. The Commuter Licensing dialog appears.
2. Click **Single Server...** and specify a server name, then click **OK**. Alternatively, click **Search Subnet**. Available licenses are displayed.
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)

Use the `ltcommute` utility for the win32 and win64 platforms.

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 have GeoExpress Remote Edition, which must be served from a valid License Server (see above). For more information contact your LizardTech representative.

Frequently Asked Questions

Following are answers to some frequently asked questions. If the information you need is not among the answers here, see for a brief outline of where to find particular information in this documentation.

Questions about Data Cartridges

Q: 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.

Q: 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.

Q: 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.

Q: 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.

Q: 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 9 and *Floating Licenses* on page 219.

Q: How do I specify a License Server?

License Server options are accessible on the Options menu under “Licenses”.

Q: 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.

You may also specify whether or not GeoExpress should prefer a NITF-enabled license if it has to go to the network to get a license. By default, GeoExpress gives preference to a non-NITF-enabled license. You can change this on the License Management dialog box (see *Setting License Server Options* on page 221).

Appendix C - Summary of Menu Options

File Menu

The **File** menu enables you to add images and tiles to the **Job List** and work with GeoExpress project (.prj) files. A project file is a collection of jobs and global settings.

Menu Item	Shortcut	Function
Add image(s)...		Enables you to add input files to theJob list. The supported image formats are TIFF/GeoTIFF, AUX (special mosaic text file), raw (BIP/BIL/BSQ), Windows BMP, Erdas Imagine, JPEG/JFIF, JPEG 2000, LAN, MrSID, NITF, Sun Raster, and USGS DOQ. File types are determined by file extensions, and if a file with an unrecognized file extension is selected, you will be asked to identify the file type via the "Identify File Type" dialog.
Create new mosaic of images...		Adds an empty Mosaic job to the Job list. You must specify the file type of the source images that will be used in the mosaic. (For supported file formats in GeoExpress see *Supported Input Formats* on page 26.) User can also select a multi-resolution mosaic option and whether the output mosaic is a flat file or composite MrSID mosaic (MrSID format input files only).
Add color composite image to encode...		Enables you to add an image job consisting of separate source files that represent the red, green, and blue bands of a single image. A dialog box is presented with options for adding each band, and at least one band must be supplied.

Menu Item	Shortcut	Function
		All of the bands must be single banded images of the same file type and have the same dimensions and resolution.
New project	Ctrl+N	Clears the current project and gives you a new empty project to populate.
Open project...	Ctrl+O	Enables you to open a previously saved GeoExpress project file from disk. If the project file was created by MrSID GeoEncoder, the application gives you the option of converting the file and saving it to a new file. Project files are supported for previous versions of GeoExpress.
Save project	Ctrl+S	Saves the current project file to the existing project file on disk.
Save project as...	Ctrl+Shift+S	Saves the current project file to a new file, which is specified by the user via a standard Save File dialog box. The application saves project files in the GeoExpress .prj format.
Print session log	Ctrl+P	Prints out the log of all encode jobs run since the application was opened. This is the same information displayed in the Encode Results window on the Output tab of the Job Properties panel.
Recent projects		Keeps a list of the last four project files to be accessed, so they can be quickly loaded without having to go through an Open File dialog.
Recent files		Keeps a list of the last four non-project files to be added to the project, so they can be easily added to the Job list.
Exit	Ctrl+Q	Enables you to save your current project and/or cancel the current encode operation before it shuts the application down.

Jobs Menu

The **Jobs** menu provides another means of executing jobs.

The **Jobs** menu consists of the following items:

Menu Item	Function
Run selected jobs	Runs all the jobs that are selected in the job list.
Run all jobs	Runs all jobs, whether selected or not.

Options Menu

The **Options** menu provides access to basic encode parameters, preferences and licensing.

Menu Item	Function
Job options...	Displays the most common options for the selected job, including compression options, output options, and more.
Advanced options...	Displays advanced job options for the job, including transparency options, band options, format-specific options, and more.
Tile options...	Brings up the Tile Manager and is only selectable when a mosaic file is highlighted in the Job list. This dialog enables you to add and remove tiles from the selected Mosaic or Update job. It also has an option for cropping tiles, which invokes the Crop Manager. The “Move Up” and “Move Down” buttons change the order of the selected tiles in the list, and tiles can also be added and rearranged by dragging and dropping.
NITF image segments...	Displays the image segments in the selected NITF file.
Preferences...	Select the default preferences for raster files. You can edit the default output directory and file format, set a default compression ratio for each file format, and more.
LiDAR Preferences...	Select the default preferences for LiDAR files. You can edit the default compression ratio, the default number of points to display in the preview of point clouds, and more.
Licensing	Enables user to specify a preferred License Server or that preference be given to a NITF-enabled license if one is available.

Tools Menu

The **Tools** menu offers options related to more complex encoding functions.

Menu Item	Function
Metadata...	Brings up the Metadata Manager. This provides fields for inputting the classical MrSID user metadata tags for company name, copyright, credit, summary, keywords, comments, image ID, imaging date, imaging time, source device, scan info, and geographic location. These tags are only available for MrSID Image and Mosaic encode operations.
Despeckling...	Brings up Despeckling Options dialog, where you can choose to despeckle your image or tile and set despeckling options.
Image crop...	Brings up the Image Crop dialog box. This tool enables you to specify a region of interest for the selected job by entering coordinates in the text fields or by drawing a rectangle in the visual representation of the image. You can choose to represent the region of interest in either pixels or geospatial coordinates. The supported rectangle descriptions are edge offset (the classical format), upper-left lower-right, upper-left width-height, and center width-height.
Area of interest…	Brings up the Area of Interest dialog box. The area of interest controls look and operate much the same way as those of the image crop function. However, whereas image crop permanently removes all data from the area outside the desired region, area of interest can be used to increase or decrease the level of visual quality in a particular region of an image, or to make a desired region download completely before the rest of the image is resolved.
Color balance…	Brings up the Color Balance dialog box, enabling you to balance brightness, contrast and color values among mosaic tiles.
Reproject...	Brings up the Reprojection Manager enabling you to reproject one or multiple images from one spatial reference system (SRS, sometimes also called a coordinate reference system or CRS) to another.
Data cartridge...	Brings up the Data Cartridge Manager, which has tabs for configuration, administration, and history of the Express Cartridge Manager (ECM).
Publish images…	Brings up the Publish Images dialog box, enabling you to publish existing images directly to an Express Server.

Help Menu

The **Help** menu provides information about GeoExpress and access to additional resources.

Menu Item	Shortcut	Function
Contents...	Ctrl+H	Invokes this online help system.
About GeoExpress 9.5...		Displays product information and legal text, along with the version number of the software.
LizardTech online tech support...		A hyperlink to LizardTech's support website that invokes your default HTML browser.
Open log files folder		Opens the directory containing session and job logs.

Appendix D - Company and Product Information

GeoExpress Feature History

The following features and improvements to existing functionality were added in past versions of GeoExpress.

GeoExpress 9.1

Floating Point Support for MrSID Generation 4

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.

Dynamic Range Metadata Generation

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 12 bits, then you may want to use dynamic range stretching to improve the appearance of the image.

Improved Metadata for Auxiliary Files

When you create an auxiliary file for an image, GeoExpress writes additional metadata into the auxiliary file. If the image contains regions without image data, the no-data values are stored in the auxiliary file. Additionally, if you generate dynamic range metadata for the image, the dynamic range values are stored in the auxiliary file.

Improved Multi-Core Processing

The performance of multi-core processing has been improved. Each job that you run in GeoExpress uses less processing power and finishes faster.

Command Line Image Statistics

You can calculate image statistics for each band in an image from the command line. The image statistics include the minimum value, the maximum value, the mean value, and the standard deviation. Enter the following command to calculate statistics for an image:

```
mrsidgeoinfo -stats <Image Name>
```

GeoExpress 9.0

Simple Job List

Any images that you add to the GeoExpress graphical user interface appear in the same simple job list. You can view and run all jobs in the same job list regardless of the image compression

and manipulation operations that you want to perform. Previously, jobs were scattered across multiple tabs.

Intelligent Encoding

GeoExpress automatically uses its optimization feature whenever possible. The optimization feature performs a subset of image compression and manipulation operations without re-encoding images. Previously, to use optimization you needed to remember which operations supported optimization, and you needed to add images to a separate **Optimize** tab.

Graphical User Interface Enhancements

The user interface includes updated window graphics and icons.

Concurrent Processing

If you run GeoExpress on a machine with a multi-core processor or on a machine with multiple processors, GeoExpress creates multiple threads to process jobs more quickly. The number of threads and jobs that you can run at one time depends on the number of cores in your machine's processor.You can use a maximum of eight cores for image encoding.

Image Rotation

For images that include rotation metadata, GeoExpress creates rotated output images. This feature is turned on by default so that your images are displayed with the correct orientation even in viewers that do not support metadata for image rotation. Previously, GeoExpress preserved rotation metadata without rotating the output image.

Custom Watermarks

You can add custom watermarks to your images. GeoExpress supports watermark images in BMP, PNG, and JPEG formats. You can use black and white images with maximum dimensions of 128 pixels by 128 pixels.

Mosaic Enhancements for the Command Line

You can create mosaics that use multiple coordinate reference systems from the command line.

PNG Support

GeoExpress now supports PNG files. You can perform any operation with PNG files that you can perform with other supported file formats.

NITF RPC Support

GeoExpress can now interpret NITF files with RPC metadata.

GeoExpress 8.5

Per-Band Compression

As of GeoExpress 8.5, you can specify a different compression ratio for each band or any group of bands in a multispectral image. Customize the compression of your imagery band by band.

Improved License Administration

GeoExpress 8.5 made it easier for you to control how many of your network license seats can be checked out as commuter licenses (used without a connection to the network).

GeoExpress 8.0

Support for MrSID Generation 4 (MG4)

GeoExpress 8 introduced compression of raster imagery to MG4, the latest version of the MrSID image compression format. MG4 files can be viewed in either of LizardTech's free viewers, GeoViewer and ExpressView Browser Plug-in.

Alpha Channel Support

As of version 8 GeoExpress uses the alpha masking capabilities in MG4 to enable you to specify which areas of your imagery you want to be transparent (nodata areas) and opaque, then creates an alpha mask and stores it in an alpha band or alpha channel. The alpha band is preserved losslessly even when you are encoding lossily, so that your imagery is always free of the speckling artifacts that can appear after compressing nodata.

Multispectral and Hyperspectral Support

GeoExpress 8 introduced support for multispectral and hyperspectral images, enabling you to compress up to 255 bands. Whether you need to compress 4-band color images containing an infrared channel, take advantage of the latest 8-band satellite imagery, or compress high-resolution RGB datasets, GeoExpress has you covered.

Improved Mosaicking Options

GeoExpress 8 also introduced improved mosaicking options. Previously, mosaics were either quick to create but slower for end users to open, or took a long time to create but opened rapidly in viewing applications. Now you can combine thousands of MrSID files without spending valuable time reprocessing them. MG4 mosaics open as quickly as a single image, so you save time creating images and your users save time viewing them.

GeoExpress 7.0

Support for Publishing to Express Server

As of GeoExpress 7, export imagery to Express Server (version 6.0 or later) directly from GeoExpress. Newly encoded imagery can be output directly to an Express Server and you can publish your existing images to an Express Server without having to reencode them.

Administer Express Server from GeoExpress GUI

The optional Express Server Management Console is an easy-to-use Microsoft Management Console (MMC) snap-in included on your product CD-ROM. Once installed, it can be accessed directly from the GeoExpress toolbar for creating, indexing, and managing catalogs of MrSID and JPEG 2000 imagery.

Support for 64-Bit Systems

As of GeoExpress 7, take advantage of more memory (4+ GB) to create mosaics of imagery multiple terabytes in size. Encode your MrSID imagery faster than ever before by being able to use today's advanced systems.

Commuter Licenses

As of GeoExpress 7, you can “check out” a floating license for your laptop and take it off the network. Use GeoExpress’ manipulation and encoding functions in the field without having to purchase and activate standalone licenses.

Support for Generating Esri AUX Files

Generate AUX files for georeferencing. Make sure the metadata in your MrSID and JPEG 2000 imagery will be readable in Esri applications by generating an Esri AUX file when encoding.

Support for Cropping by Shape File or GML Coverage

By selecting a shape file or GML coverage you can crop by a complex polygon rather than a simple square.

Other Features, Improvements, and Fixes

Despeckling – Take advantage of GeoExpress 7’s despeckling technology to remove compression artifacts at the edge of images and make your mosaics look cleaner.

"Recently Used" Projections Feature and Updated Library – GeoExpress 7 saves you time by making it easier to select the coordinate systems you use most often. Also, support for over 500 additional EPSG coordinate reference systems has been added to GeoExpress.

Improved Status and Error Messages – GeoExpress 7 makes it easier to determine what licenses are being used and assist with troubleshooting.

Improved Metadata Tools – Edit your MrSID and JPEG 2000 imagery's custom metadata tags and add new ones. Edit the coordinate system of your imagery without having to reencode. Use your custom metadata tags to build robust, flexible Web applications with LizardTech Express Server.

Expert Level Tools – Demosaic or “tile out” your imagery by specifying a grid. Easily decode all or part of your MrSID or JPEG 2000 image to GeoTIFF directly within GeoExpress. No need to learn command line tools.

GeoExpress 6.1

GML Metadata for JPEG 2000 Imagery

As of version 6.1, GeoExpress enables you to add GML metadata to JPEG 2000 imagery. GML stands for Geographic Markup Language, a specification ratified as a standard by the Open GIS Consortium (OGC) in 2005 and the ideal way for geospatial image metadata to be included within the JP2 file format. Now you can give your JPEG 2000 imagery "spatial awareness" with the most advanced method available today for including geographic metadata in your JP2 files. LizardTech's support for GMLJP2 means you can increase the value of your geospatial imagery using the same familiar GeoExpress workflow. Now when you mosaic, color balance, reproject, and specify areas of interest in your JPEG 2000 imagery, you can also include GML metadata and the GML schemas that downstream applications will use to integrate and make use of your imagery in geospatial workflows.

Nonuniform Color Balancing

The color balancing functionality introduced in GeoExpress 6.0 was expanded in version 6.1 to address several kinds of nonuniform tonal imbalance. Tilt, vignetting and seam lines can be corrected as part of the familiar GeoExpress image processing workflow.

Publishing MrSID or JPEG 2000 Images to Oracle

As of version 6.1, GeoExpress enables you to publish SID and JP2 images to Oracle Database 10g either as direct output from the encoding process or as a publishing operation on existing imagery.

GeoExpress 6.0

Color Balancing

As of version 6.0, a color balancing tool enables users to perform histogram matching on image tiles being mosaicked together, reducing the patchy effect that often results from the joining of adjacent tiles that were captured at different times or in different conditions.

Vector Overlays for Area of Interest Encoding

As of version 6.0, GeoExpress supports using vector overlays for encoding multiple, non-rectangular areas of interest.

Floating Licenses

As of version 6.0, GeoExpress enables greater flexibility for multiple users in networked environments by supporting floating licenses. Floating licenses can be obtained from a license server that is included on the GeoExpress CD; users check out a license while they work, and when they are finished the license becomes available again to other users.

Other Improvements

As of version 6.0, GeoExpress:

- supports 12-bit JPEG-encoded variants of input formats such as TIFF and NITF*
- allows users to edit encode jobs while other jobs are encoding in the background
- includes a check box among the Output options for converting incoming 16-bit data to 8-bit data during encoding
- supports encoding 16-bit DTED images to JPEG 2000
- adds improved support for custom well-known text strings (WKTs).

GeoExpress 5.0

Reprojection

As of version 5.0, GeoExpress enables users to reproject images from one coordinate reference system (CRS) to another. GeoExpress supports reprojection for MrSID Generation 3 (MG3), JPEG 2000 and NITF 2.1* output formats. Reprojection controls are located on the Reprojection tab of the Encode Options dialog.

JPEG 2000 Support

GeoExpress 5.0 includes full support for JPEG 2000 as an output image file format. Now you can use JPEG 2000 compression on geospatial images with the same level of efficiency, metadata, and large-image support already available with MrSID. The JPEG 2000 image compression standard describes many of the advantages that have been implemented for years in the MrSID format, plus the added benefits of being an international standard (ISO/IEC 15444).

Profile Manager

With the addition of support for JPEG 2000 images, GeoExpress 5.0 introduced a Profile Manager for handling the various encoding parameters that JPEG 2000 uses. A profile is a collection of settings that can be applied to the creation of a JPEG 2000 file. GeoExpress installs several industry accepted profiles and enables users to create and save their own custom profiles.

Multiband Color Compositor

The color compositor allows the creation of multiband JPEG 2000 files from a collection of single-band grayscale image files. The input files must all have the same dimensions, resolution, bit depth, and geographic positioning. Empty bands are allowed, and treated as zero data.

NITF Support*

NITF 2.1 images can be encoded as either raw or JPEG 2000 files.

*Support for encoding NITF images is available for GeoExpress. Contact your LizardTech representative to purchase the NITF Extension for GeoExpress.

Area of Interest Encoding

The area of interest functionality in GeoExpress can be used to increase or decrease the level of visual quality in a particular region of an image. For example, a large image of a city in the desert may be encoded with a lower compression ratio for its urban region while the outlying areas are more aggressively compressed, thus preserving greater detail only where it is needed and elsewhere gaining the file-size advantages of higher compression. In the opposite way, the United States White House or any other sensitive area of an image can be “blurred” through area of interest encoding so that detail may not be viewed. Area of Interest can also be used to make a desired region download sooner than the rest of the image, which can be very useful across networks and for end-users with low bandwidth.

GeoExpress 4.1

Encoding Options

Color Space Tab – The MrSID file format does not support multispectral color spaces, so in order to accommodate multispectral input files, an output or “target” color space and band orientation

must be specified. A Color Space tab appears on the Encode Options dialog box for this purpose. The target color space is only supported for encoding single images and flat image mosaics.

Transparency Tab – To handle multispectral imagery, the controls on the Transparency tab of the Encode Options dialog box were updated to handle any number of bands.

Multispectral Image Support

As of version 4.1, GeoExpress accepts multibanded image files as input. Multispectral imagery must conform to the following criteria:

- The data type for the imagery must be 8-bit or 16-bit
- All bands must be of the same data type
- Users can preview multispectral images by viewing the individual bands, or by combining them in an RGB triplet. The MrSID image format does not support arbitrary color spaces with n bands, so multispectral input images can only be encoded to a user-specified color space (e.g. RGB).

In order to support viewing multispectral images, a band selector feature was added to the Preview tab. If the input source image is multispectral, the "Band Selector" button is available on the Preview tab toolbar. Selecting the "Band Selector" button activates the band selector controls, which then appear on the right side of the preview window.

Improved World File Handling

World file handling was both simplified and improved to support all input file formats in a uniform way, not just TIFF and GeoTIFF. In the Preferences dialog box, the "Allow georeferencing from *.tfw to override GeoTIFF" option was replaced with the more useful "Allow world files to override native georeferencing" option, which applies to all image formats that support world files. This option is selected by default, so that world files are always honored. If you wish to ignore world file data in favor of an image format's native georeferencing (like GeoTIFF or MrSID), deselect this option.

> *NOTE: This behavior is different from that of versions of GeoExpress previous to 4.1, which ignored TIFF world files (*.tfw) by default and only allowed world files to be ignored for GeoTIFF images.*

Enhanced Optimizing Options

As of GeoExpress 4.1, optimize jobs accept MrSID composite images as input, provided that they contain only MrSID Generation 3 (MG3) tiles.

Internationalization

With version 4.1, GeoExpress became internationalized to help serve the global community, and now accepts double-byte file names as both input and output.

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 the following URL:

http://www.lizardtech.com/downloads/category/#viewers.

ExpressView Browser Plug-in

Fast and Easy Viewing of Large Images

ExpressView™ Browser Plug-in enables you to view, navigate and print MrSID and JPEG 2000 imagery in Internet Explorer or Firefox. Like GeoViewer, ExpressView enables you to save a portion of an image in a number of other image formats. ExpressView Browser Plug-in is quickly downloaded, easily installed, and free for individual use. It's the most convenient way to view MrSID and JPEG 2000 imagery over networks!

For more information about ExpressView Browser Plug-in, visit the following URL:

http://www.lizardtech.com/downloads/category/#viewers.

LiDAR Compressor

LiDAR Data Meets the MrSID Format

LizardTech LiDAR Compressor™ software enables you to turn giant point cloud datasets into efficient MrSID files that retain 100 percent of the raw data at just 25 percent or less of the original file size (lossless compression). If storage requirements are critical, you can reduce your LiDAR file sizes by 90 percent or more by choosing a higher compression ratio and letting LiDAR Compressor select the best way to reach a desired file size (lossy compression). Unlike raw LAS or ASCII data, LiDAR files compressed to MrSID are easily managed resources you can extract derivatives from again and again.

For more information about LiDAR Compressor, visit the following URL:

www.lizardtech.com/products/lidar/.

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 the following URL:

http://www.lizardtech.com/products/exp/.

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 LiDAR Compressor™ and its 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 at the following URL:

http://developer.lizardtech.com.

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, Denver, London and Tokyo and is a division of Celartem Technology Inc. For more information, visit www.lizardtech.com.

Appendix E - Troubleshooting

This chapter offers information to help you solve issues and recognize error messages you may encounter using GeoExpress.

Installation Problems

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

Invalid License Code Entered

The license code was entered incorrectly. The license code is stored in the GeoExpress9\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 (`#`) 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 the entire string is copied, and it is recommended 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.

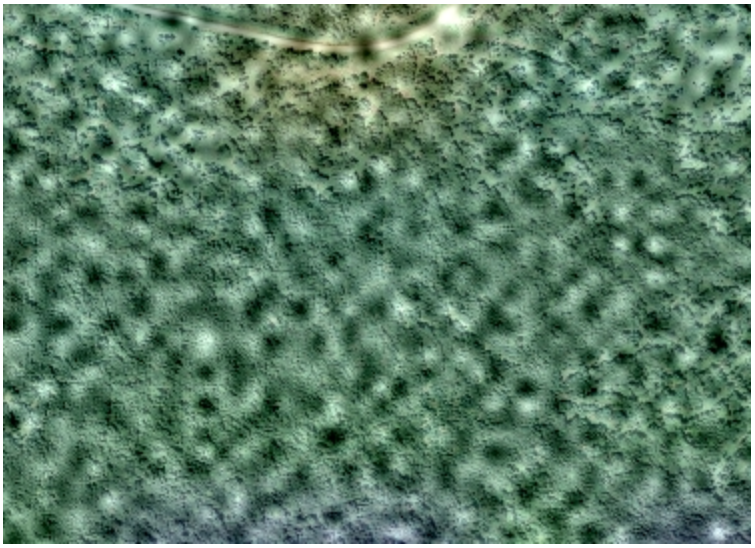
License Timed Out Early

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 http://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, complete the following steps:

1. Select the image in the **Job List**.
2. Click **Advanced** in the **Properties** tab.
3. Click the **Format-Specific** tab.
4. Increase the value in the **Weight** field. For example, you might change the value from 2 to 3.
5. Optionally, deselect the **Image Enhancement** option.

6. Click **OK**.
7. Click the **Run Selected Jobs** button to run the job.

Finding Your GeoExpress 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, select **About GeoExpress** from the **Help** menu.

The version and build numbers are listed on a single line at lower left, in the following format:

Version: 9.5.0.0.3325.default

In this case, the version number is "9.5.0.0" and the build number is "3325".

Below that, a parenthetical note tells you whether the installation is a 32-bit or 64-bit version of GeoExpress.

Technical Support

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

Knowledge Base

http://www.lizardtech.com/support/kb/

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

Community Forums

http://www.lizardtech.com/forums/

The forums comprise a place to engage in intelligent discourse with the geospatial community. Ask questions, provide answers, and share product usage tips with other Lizardtech customers around the world.

Product Updates

http://www.lizardtech.com/products

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

Support Plans

http://www.lizardtech.com/purchase/other.php

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

Contacting Technical Support

To contact LizardTech Technical Support, navigate to the following URL in a web browser:

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.

IMPORTANT: 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 GeoExpress Version and Build Numbers* on page 251).
- Other LizardTech products you have installed
- The operating system installed on your machine
- The amount of hard drive space available on your machine
- The amount of memory available on your machine
- Any other information you feel is relevant

Glossary

Following are descriptions of some terms, phrases and acronyms used in this documentation.

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

See 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

The order in which bytes are stored in computer memory. There are two types, little-endian and big-endian.

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 one has half the width and height of the original. See also scale and magnification.

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