Tutorial: Combining Separate Image Files into a Single Multispectral Image File

Requirements: MultiSpec application & images titled "LE7_20000606_Indy_subset_Bn.tif"

One can use the "Logically Linking" capability in MultiSpec to link several image files together to be treated as one image file in an image window and/or create a new image file that incorporates all of the separate images. For example many times one will receive Landsat images from the EROS Center by electronic download that contains one file for each of the 7 (TM), 8 (ETM+), or 10 (LC8) bands. This exercise will illustrate how to do this.

Beginning with the 3.14.2013 version of MultiSpec there is a new approach to combine separate image files which takes fewer steps. The multiple selection (easiest) approach is described in section 5.1. The second single selection approach is described in section 5.2.

Section 5.3 describes how to create a single image file which includes the selected individual image files.

Please refer to section 5.4 if not all of the images files to be linked are at the same spatial resolution. This may the case for the Landsat thermal bands. Currently though, most of the thermal data files in the Landsat image data sets that are downloaded from the EROS Center have already been re-sampled to the sample spatial resolution as that for the reflective data.

Section 5.5 describes how MultiSpec automatically links files in HDF or HDF5 format. An ASTER data set is used for illustration.

Section 5.6 describes how MultiSpec can automatically links files in FAST-L7A Format.

NOTE: One can also link multiple image files together that represent multi-temporal data from the same location, provided that line and column numbers for the given pixel ground locations in the separate image files from each of the times have been made to correspond with each other.

5.1   Multiple selection approach: For this approach, one selects all of the images to be linked at one time in the Open Image File dialog box before selecting the **Open** button.

5.1.1 Select the **File->Open Image…** menu item. Then select the images to be linked as illustrated in the figure below.
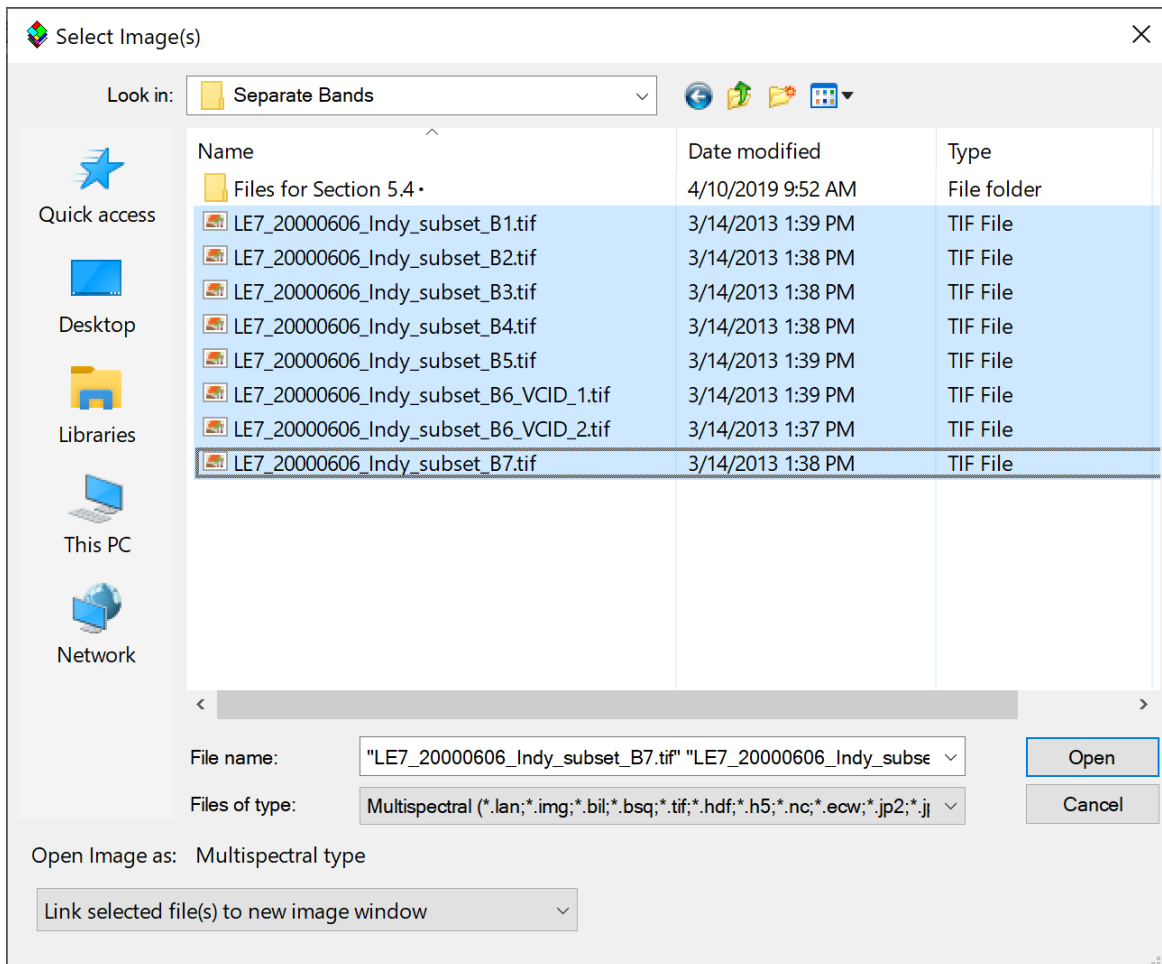

One will need to change the popup menu in the lower left to "Link selected files to new image window". Then select the **Open** button. (If one does not change the popup menu in the lower left to the link option, one will get a message asking you whether you do wish to link the image files.) The "Display Multispectral Image" dialog box will be presented to allow one to display the image representing the linked image files.

NOTE: MultiSpec will order the Landsat image data files in wavelength order. See section 5.2 if one wishes the bands to be ordered in a different way.

5.1.2 One can now run the Display Image, Histogram, List Data, Principal Components, and Reformat processors on the "logically linked" image. One cannot use this "logically linked" image as a base image for a Project (see section 5.3 for the procedure to do this).

5.1.3 An example of a selection for Landsat 8 data follows.
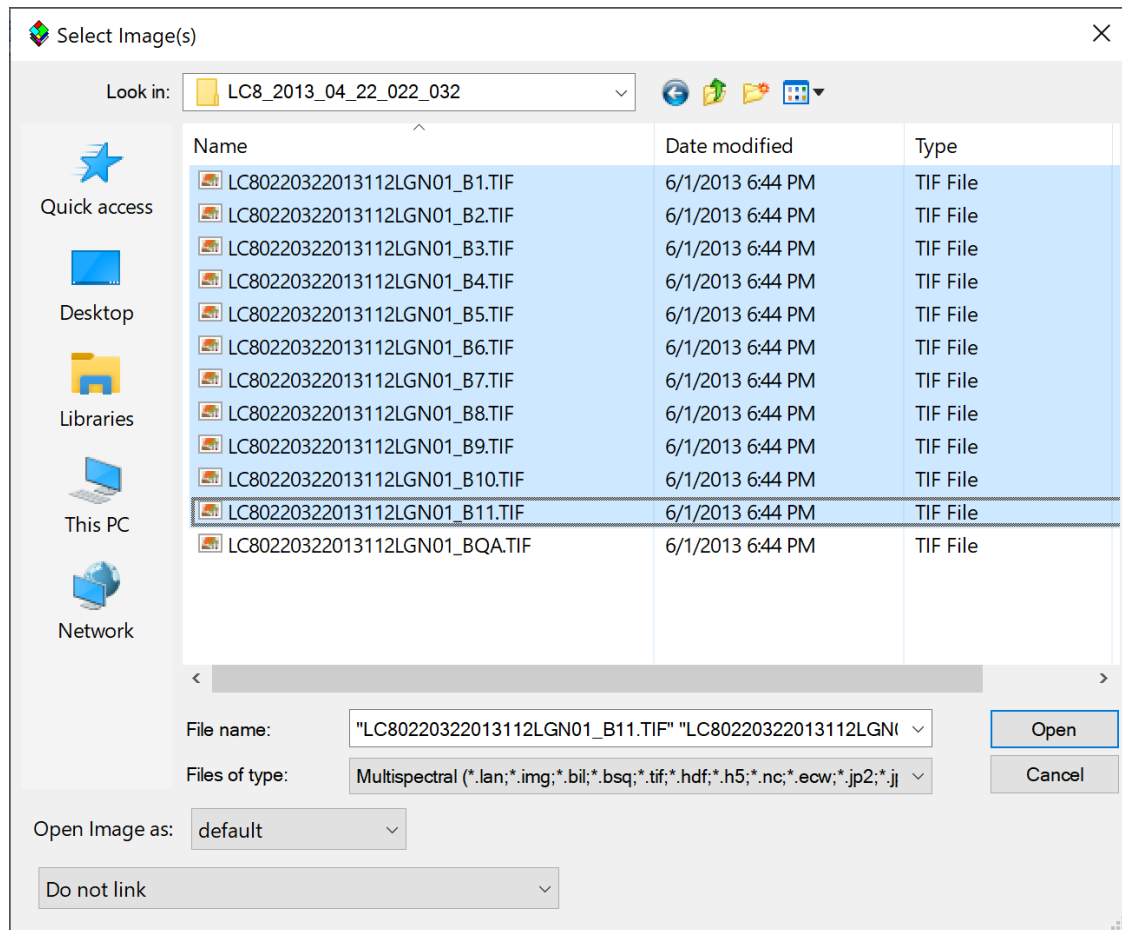
The panchromatic band (number 8) will be ignored since it has a different number of lines and columns than band 1 does.

5.1.4 Additional rules and limitations on "multiple selection" Logically Linking are:

- One can only link image files that are being used in multispectral type image windows.

- Any image files in a multiple selection set which contains a different number of lines and columns than the first selected image will be ignored. A message to this affect will be listed in the output text window.

-The separate image files may contain a different number of data bytes, a different number of channels and they can be a mixture of band interleaved by line (BIL) and band sequential (BSQ) formats. (Note that band interleaved by sample or pixel (BIS or BIP) formats cannot be used in logically linked image files. One will need to change the BIS formatted file to BIL or BSQ first.)

- Any shape files in a multiple selection will be ignored.

- The limit for the number of files in a multiple selection is 1000.

5.2   Single selection approach: This approach involves selecting the images to be linked one at a time within the Open Image File dialog box. It is useful if one needs to link the image files in a different order than they are listed in the dialog box or in the way that MultiSpec orders the Landsat data files downloaded from the standard EROS Center. (MultiSpec orders the image files in wavelength order.)

5.2.1 Open the first multispectral image as one normally would using the **File->Open Image…** menu item. The "Display Multispectral Image" dialog box will be presented to allow one to display the selected image. One may display the image or just cancel the dialog box. A blank multispectral image window will continue to be displayed. This will become the "active" image window that represents the first image file that will be used in the next steps.

5.2.2 To link an additional image disk file to the active image window, use the **File->Open Image…** menu item again. Change popup menu in the lower-left portion of the dialog box displaying "Do not link" to "Link selected file(s) to active image window". Then select the 2nd image file (such as band 2 illustrated in the figure below) to be linked to the active image window.
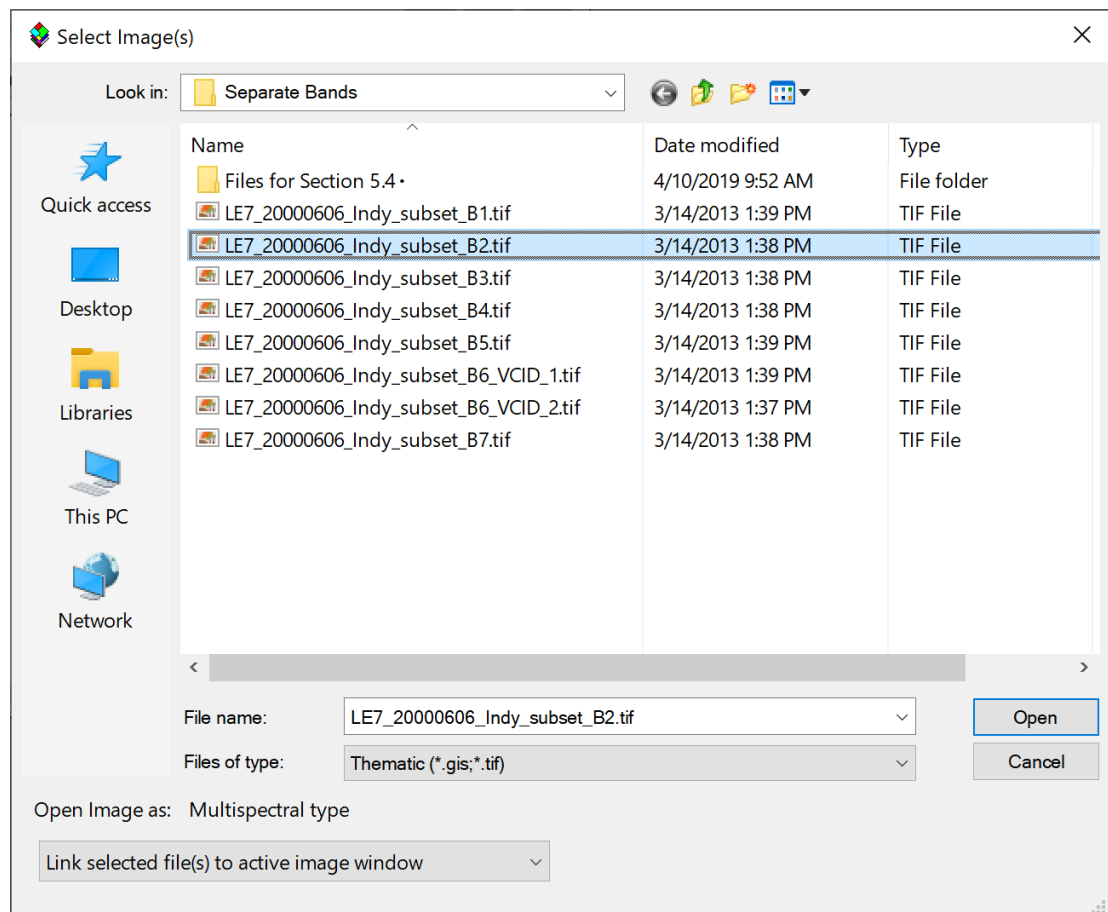
As long as Cancel is not selected, the open image dialog box will automatically be displayed to allow the user to link additional image files to the active image window. The title for the open image dialog box will indicate the number of files that will be linked with the selection to be made. Also the name of the image window is prefaced with 'Ln-' where n is the number of files that are linked for that image window.

5.2.3 Select 'Cancel' after all desired image files have been linked. Note that one wants to link them in the order that you want the channels to be treated. For example, many times Landsat TM data is in the order of bands 1 thru 7. However, if you would like for the channels to be in wavelength order, then select in order of bands 1, 2, 3, 4, 5, 7, 6 or for this example 1, 2, 3, 4, 5, 7, 6_VCID_1, 6_VCID_2.

5.2.4 After linking the separate disk files together, one can run the Display Image, Histogram, List Data, Principal Components, and Reformat processors on the "logically linked" image. One cannot use this "logically linked" image as a base image for a Project (see section 5.3 for the procedure to do this).

5.2.5 Some additional rules and limitations on Logically Linking are:

- One can only link image files that are being used in multispectral type image windows.

- Image files that can be linked may contain a different number of lines and columns. The resulting linked image will contain the largest number of lines and columns that includes the union of those in the separate image disk files. Also the separate image files may contain a different number of data bytes, a different number of channels and they can be a mixture of band interleaved by line (BIL) and band sequential (BSQ) formats. (Note that band interleaved by sample or pixel (BIS or BIP) formats cannot be used in logically linked image files. One will need to change the BIS formatted file to BIL or BSQ first.)

- All image files will be overlaid by starting with the first line and first column in the disk file. No provision has been provided to overlay the image files using different line and column offsets or by latitude/longitude.

5.3   **Combining Files into a Single New File:** Use the **Reformat->Change Image File Format…** menu item to create a new disk file that contains all the channels included in the "logically linked" image files. The default options are usually sufficient but you can change them as desired. If the map projection information is known for the image and included with the input images, the GeoTIFF format is a good Header option to use to keep that information with the new image file.


After selecting "OK", you will have the opportunity to name the file before it is created or use the default name provided. This new file can then be used as a base image for a project.

5.4   **Handling Differing Spatial Resolutions**: The thermal channel for many older Landsat data
sets may be at a different spatial sampling than that for the reflective channels. One cannot
link the thermal channels without first creating a new thermal image file that has the same
spatial sampling as that for the reflective channels. One can do this with a couple of additional
steps using the **Processor–>Reformat–>Rectify Image…** menu item in MultiSpec. The
following steps are specifically for Landsat 7 thermal data. They can be modified for other
kinds of images.

- Open band 1 (LE7_20000606_Indy_subset_B1.tif) from the set of multispectral images to
be linked using the **File–>Open Image…** menu item. The "Display Multispectral Image"
dialog box will be presented to allow one to display the selected image. One may display
the image or just cancel the dialog box. A blank multispectral image window will continue
to be displayed.

- Open the first thermal band (LE7_20000606_Indy_subset_B61.tif).

- Make sure the image window for the thermal channel is the active image window and then
select the **Processor–>Reformat–>Rectify image**… menu item. Select "Reproject" in the
Rectification Settings group in the "Set Image Rectification Parameters" dialog box as
illustrated in the figure below. Also verify that "LE7_20000606_Indy_subset_B1.tif" is the
reference image.
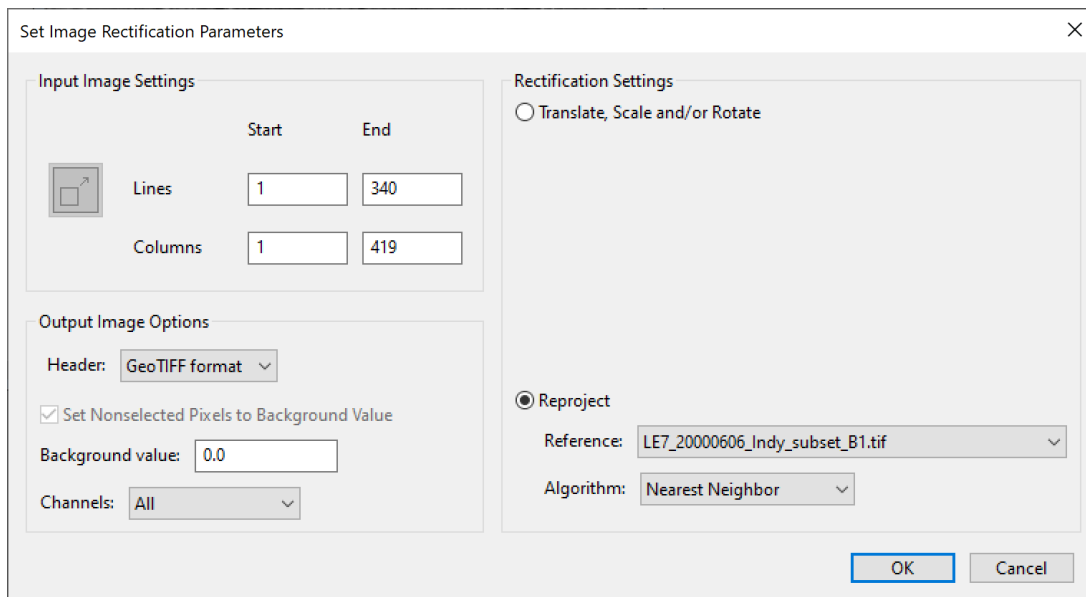
- Select OK and enter the name for the new rectified thermal image
(LE7_20000606_Indy_subset_B61_30m.tif). A new thermal image will be created such that
it contains a thermal value that matches the location for each pixel in the reference image
using nearest neighbor as the sampling scheme.

- Close the first thermal image window and open the second thermal band
(LE7_20000606_Indy_subset_B62.tif). Follow the same procedure used above to create
"LE7_20000606_Indy_subset_B62_30m.tif".

Or one could have linked both ...B61.tif and B62.tif files and just worked with the linked file
to create a resampled image of both at the same time.

5.5   **ASTER HDF Files**. MultiSpec will automatically link the ASTER channel sets 1, 2 and 3N (VNIR) together if any one of these data sets is selected in the hdf file. The same is true for the SWIR set of channels (4-9) and the TIR set of channels (10-14). See example below.

Set Multispectral File Format Specifications   ✕

For: AST_L1B_003100120051001.hdf

Size Specifications

Number of Lines	4200	Preline Bytes	0
Number of Columns	4980	Postline Bytes	0
Number of Channels	3	Prechannel Bytes	0
Start Line Number	1	Postchannel Bytes	0
Start Column Number	1		

Band Interleave Format: Band Non-sequential   ⌄

Data Value Type: 8-bit Unsigned Integer   ⌄   ☐ Swap Bytes
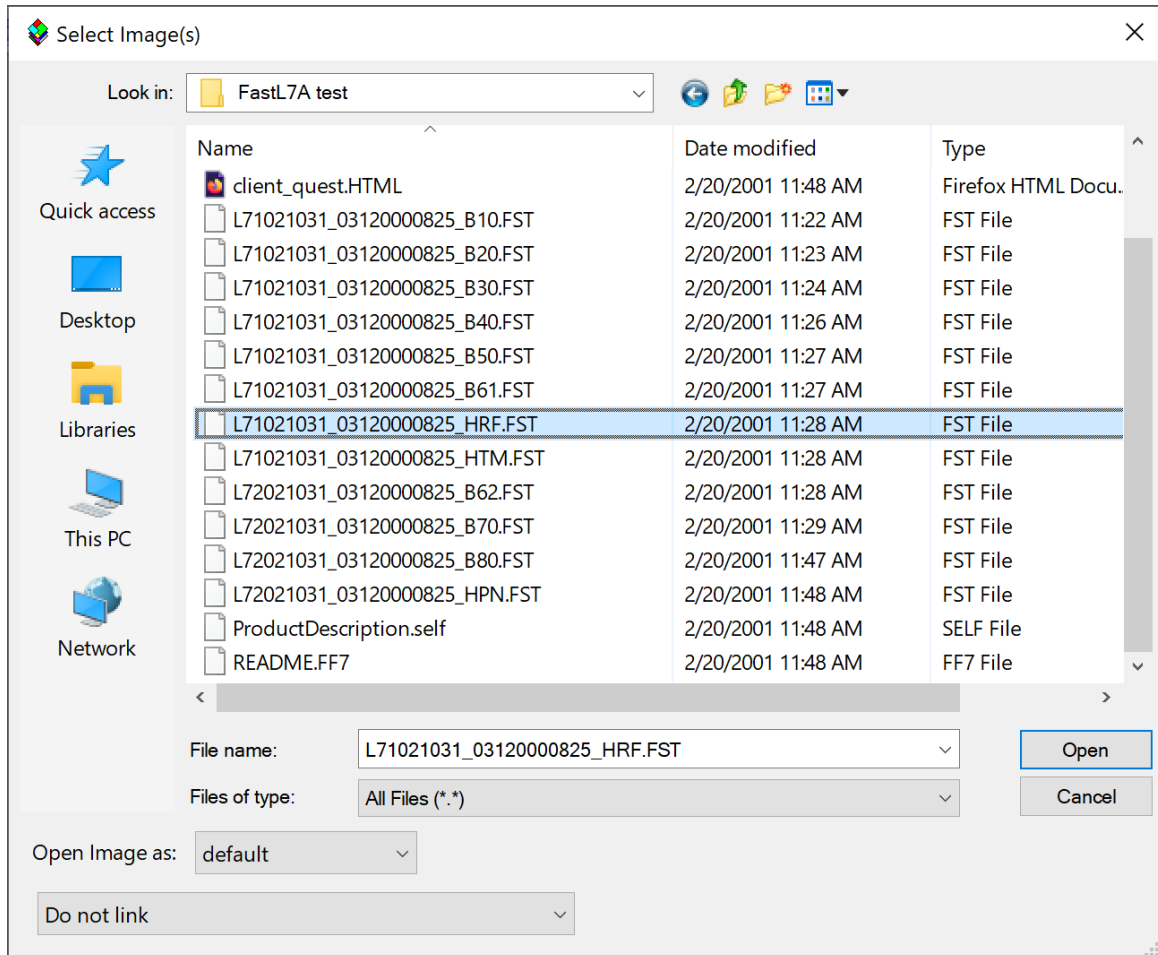
☐ Treat Lines from Bottom to Top

☐ Data Fill Value:

HDF Data Set: *ImageData1_G1   ⌄   ?

*Latitude
*Longitude   cel
*ImageData1_G1
*ImageData2 G1

5.6 **FAST-L7A Format**. MultiSpec will automatically link all bands in the FAST-L7A formatted group identified in the header if a one selects the header file such as …HRF.FST for reflective data (bands 1-5 & 7) and HTM.FST for thermal data (bands 61 & 61).

You can then link groups of bands if one wants (and if the images make sense to do that). FAST-L7A is one of the older formats used for the Landsat 7 data.

Concluding Remarks

There are many other operations that one can do with MultiSpec including several Reformatting processes. See other exercises or the MultiSpec Introduction at the MultiSpec web site for more information. The MultiSpec web site is: http://engineering.purdue.edu/~biehl/MultiSpec/. Or contact Larry Biehl at biehl@purdue.edu with questions.