Chapter 11 -- RASTER MANIPULATION

This chapter contains information pertinent to the operations which may be applied to the map raster data. Changes to the raster data will ultimately affect the vector data as well. Every map has, by definition, a raster representation. As data is imported or manually digitized, it is stored in raster format, or rows and columns of pixels which are *on* or *off.* When a map is initially created or acquired during an LTPlus session, a temporary **/u/ltp/maps** directory called **temp0** is created. A significant percentage of user operations upon the active map are stored in the files belonging to this temporary map. When the user executes a **save** command, LTPlus copies the relevant information from the temporary map to the active map's files. One of the files that the temporary directory maintains is a **raster** file, which contains the contents of the map's raster as it is modified. These changes are not transferred to the active map's raster file until a **save** command is implemented. Hence, the temporary (**temp0**) directory raster files contains the active map's raster with all of the changes made by the user, while the active map's regular raster file contains the map's raster as it appeared at the last **save** command execution.

WHOLE RASTER FILE OPERATIONS

There are seven raster commands which operate directly with a map's entire raster file, allowing the user a great deal of flexibility with regard to the contents of the raster.

The **brstr_create** command copies the temporary directory raster file to a file called **rasterb**, which is stored in the **temp0** directory until a **save** command is executed; at that time, the **rasterb** file is stored under the active map's directory. It may or may not be different from the map's regular raster file. This function can be used to save a second copy of the raster for later merging or merging selectively with the displayed raster. See the **brstr_switch** and **brstr_delete** commands. Once saved, the **rasterb** file is carried with the map until the map is purged. It may be replaced with a later version of the raster by executing the **brstr_create** and **save** commands again. Note that all normal editing and viewing done with a map is with its primary raster file; the **rasterb** file is set aside until later. It can only be accessed by switching it with the raster file (using the **brstr_switch** command). The **brstr_delete** command deletes the temporary directory **rasterb** file, if it exists. This file is created with the **brstr_create** command. The **brstr_delete** command does not **purge** the **rasterb** file stored with the active map's files. Note that all normal editing and viewing done with a map is with its primary raster file; the **rasterb** file is set aside until later. It can only be accessed by switching it with the raster file (using the **brstr_switch** command).

The **brstr_switch** command swaps the **raster** and **rasterb** files in the temporary (**temp0**) map directory. This is done to access a raster that was set aside earlier with the **brstr_create** command. Note that all normal editing and viewing done with a map is with its primary **raster** file; the **rasterb** file is set aside until later. It can only be accessed by switching it with the **raster** file (using the **brstr_switch** command). Keep in mind that any data stored in the **temp0** map directory is only stored with the active map's directory when a **save** command is executed.

The **disprstr_get** will cause the contents of the temporary (**temp0**) raster to overwrite the displayed raster. The resulting raster is a display only until either a **save** command is executed, thereby storing the displayed raster in the map's permanent raster file, or until a **disprstr_put** command is executed, storing the displayed raster in the map's temporary (**temp0**) **raster** file.

The **disprstr_mrg** command causes the contents of the temporary (**temp0**) raster to be merged with the displayed raster. The resulting display includes raster information from both files and is stored in the temporary **raster** file until a **save** command is executed.

The **disprstr_put** command causes the contents of the displayed raster to be stored in the temporary (**temp0**) raster, replacing its current contents.

The **disprstr_ers** command causes the contents of the raster displayed on the screen to be erased. This will not affect the contents of the map's current primary **raster** file unless the erased (blank) raster is saved (see **save** and **disprstr_put**).

MERGING THE RASTER IN A SPECIAL WAY

The **merge_fill** command merges the displayed and stored (**temp0**) raster in a special way. Each pixel of the display raster is examined. If the pixel is *off* and one or fewer adjacent pixels are *on* then it is replaced with the pixel in the stored file. This has the effect of merging the displayed open areas with the stored raster.

REFLECTION AND ROTATION

IMPORTANT NOTE: INVOKING THE **rotate** AND **reflect** COMMANDS AGAINST AN ASSEMBLED (VECTORIZED) FILE AND/OR ALSO ATTRIBUTED MAP IS VERY DANGEROUS! THE VECTORIZATION AND ALL ATTRIBUTES WILL BE PERMANENTLY LOST. THE MAP WILL NEED TO BE REASSEMBLED AND REATTRIBUTED. MAP REGISTRATION WILL ALSO BE LOST. THE MAP WILL REQUIRE TOTAL RE-REGISTRATION (BOTH RASTER AND GEODETIC).

A raster image may be flipped, or reflected, from right to left or top to bottom. The **reflect** command will produce a mirror image along the designated axis; the default will **reflect** along a horizontal axis (top to bottom), or the user may specify a **-h** option which will cause the raster to be reflected along a vertical axis (left to right). This command is particularly useful for correcting a map which was scanned upside down (or when the scanner operator was standing upside down).

A raster may be turned, or rotated about its center, in increments of 90 degrees (1/4 turn) by executing the **rotate** command. If no degree value is entered, the rotation is assumed to be 90 degrees. Counterclockwise rotation may be accomplished by entering a negative (-) value. Rotating a raw (unassembled) raster will require less time than rotating assembled data.

NEGATIVE AND POSITIVE IMAGES

The **negative_img** command will switch a raster into its negative image. All pixels that are *off* will be turned ***on*** and vice versa. Some scanners output scanned data as negatives, some as positives. This command can reverse the image to suit LTPlus which wants the background bits *off*.

REDUCING THE RASTER RESOLUTION

IMPORTANT NOTE: INVOKING THE **reduce_res** COMMAND WILL RESULT IN THE LOSS OF OBJECTS (ASSEMBLED OR VECTORIZED OBJECTS) AND ATTRIBUTES AS WELL AS THE RASTER REGISTRAITON. THIS COMMAND IS INTENDED TO BE USED IMMEDIATELY FOLLOWING IMPORT FROM A SCANNER, RASTER REGISTRATION WILL HAVE TO BE ESTABLISHED FOLLOWING USE OF THIS COMMAND.

The **reduce_res** command allows a raster to be reduced in size by any positive whole number factor. The reduction is done by combining a square block of pixels on the original raster into a single pixel which represents a larger area on the final raster. The user can specify a threshold. The threshold indicates how many original pixels (in one square block) must be *on* for the single final pixel which represents that block to be *on*. Note that all vector data is lost at the time of reduction. This command is meant to be used just after importing scanned data, or immediately after **thin_lines** during the first editing pass. The reason for this command is to compensate for scanners which have a fixed resolution.

MARGINS

IMPORTANT NOTE: INVOKING THE **margin** COMMAND WILL RESULT IN THE LOSS OF OBJECTS (VECTORIZATION) AND ATTRIBUTES, REGISTRATION WILL BE RETAINED.

The raster margin is a border around the entire raster image of a known, or specified width. Upon creation, a raster has a default width of 10 pixels. The **margin** command may be executed to change the width. The margin is important to the edgematching process. It is the area in which adjacent map vector data may be displayed. The margin command affects the raster display, and not the actual raster (or vector) data.

To erase from view any raster data within the margin area, execute the **erase_margin** command. This command affects the raster display only and makes no modification to the stored raster or vector data.

THE MAP FRAME

The **frame_map** command connects or disconnects the four map corners, in sequence, on the raster display. To generate a visible map border, the **d (draw)** option should be included as an argument to this command. To erase an existing map border (frame), the command should include the **e (erase)** parameter. In addition, the user may designate that the frame be calculated and drawn in the raster coordinate system by entering **r** as a parameter to this command, or in a corrected geodetic projection, by supplying a **g** with the **frame_map** command. The raster (**r**) option will simply connect the four corners as they are stored in pixel coordinates derived during the raster registration process. A geodetic (**g**) frame will connect the four corners as they are calculated from their proper geodetic positions. Note that the **level_dup** (*Chapter 8, Display Operations*) command may also be used to generate a geodetic curved or planar map frame.

RASTER ELEMENT OPERATIONS

There are nine LTPlus commands which perform specific operations upon elements of a map's raster. Typically, several of these functions are combined into a *macro* which is applied to a map's raster to accomplish some standard raster editing processes in preparation for assembling (vectorizing) the map. Remember that all of these commands affect only the raster.

FILLING AND UN-FILLING HOLES

The **fill_holes** command will evaluate the current raster and turn *on* any single *off* pixel which is surrounded on four sides (not necessarily on corners) by *on* pixels. This single *off* pixel is known as a hole. The raster need not be assembled. The inverse of **fill_holes** is **del_points**.

The **del_points** command will delete all isolated points from the current raster. An isolated point is defined as an *on* pixel completely surrounded by (8) *off* pixels. This action can be executed against a raw (unassembled) raster.

GROWING AND DELETING SPURS

A *spur* is defined as a line segment which is either connected on only one end or not connected at all. The **grow_spurs** command will add the specified number of pixels to the end of each spur (to both ends in the case of a completely disconnected segment). The value of this command is that it will automatically fill small gaps in truly continuous linework. Normally, only one or two pixels should be specified; longer additions tend to amplify errors rather than fix breaks.

The **del_spurs** command will remove all spurs which are less than or equal to the specified number of pixels included as an argument with this command.

THINNING LINES

The **thin_lines** command is used to reduce the width of all lines in a raster by deleting one pixel off of each side of a line. This is most useful for scanned data in which linework is often greater than unit width. Two arguments control the type of thinning action which occurs: the first is a code which defines the thinning type and is a mandatory parameter; the default is **0**, as described in detail below. A second, optional value identifies the number of thinning passes that LTPlus should make through the data; the default is **0**, which thins until all lines are a single pixel in width. The thinning type codes include:

- **0** = Nondestructive, leave spur ends, remove square corners and stairsteps.
- **1** = Nondestructive, leave spur ends, leave square corners and stairsteps.
- **2** = Destructive, removes all edge pixels, including all 1-pixel wide lines!!!!! (This is for special uses only, not for general consumption)

DELETING OBJECTS

The **del_objects** command is used to remove all raster data which represents the vector objects in a user-specified set. This command requires that the map be assembled. The vector file will not be modified (re-assembling the raster will update the vector data).

CREATING FILLED AND UN-FILLED PERIMETERS

The **corridors** command is used to create perimeters of a specified radius, in user_specified length units, around a defined set of objects. The object linework remains intact. Hint: to effectively create polygonal buffer areas, without the original, enclosed objects, disconnect one end of the object from the new perimeter and execute a **del_spurs 999999** command. The length units codes include:

- **0** = pixels
- **1** = map inches
- **2** = ground feet
- **3** = ground miles
- **4** = map centimeters
- **5** = ground meters
- **6** = ground kilometers

Similar to the **corridors** command, the **mask** command generates a perimeter of a specified radius, in pixel units, around all of the objects in a specified set, and then fills (turns pixels on within) the new polygonal areas.

The **open_solids** command turns *off*, or erases, all of the interior pixels of solid areas within the raster. The result is a clear polygonal area. The map need not be assembled.