GRASS Tutorial:
DLG-3 Data Extraction

Chester Kos
Mary Martin
Stuart Bradshaw

U.S. Army Construction Engineering Research Laboratory

1. INTRODUCTION

This tutorial explains how GRASS raster files are produced from Digital Line Graph Level-3 optional format (DLG-3 or simply DLG) data. This data format, developed by the U.S. Geological Survey, is described in the USGS publication entitled *Digital Line Graphs from 1:24,000 Scale Maps*.

It is assumed that the user is familiar with GRASS, and in particular with the concepts of raster maps, map layers, current regions, locations, and mapsets. The user should be able to operate within the UNIX environment. For a review of these concepts use the GRASS on-line help system (**g.help**).

2. OVERVIEW

Large quantities of data are available in a DLG-3 format. The following procedures describe the methods by which users can extract DLG-3 data from magnetic tape, and convert this data to a raster form usable within GRASS.

This tutorial assumes use of the spearfish sample database distributed to users along with their GRASS code (i.e., it assumes the user is working in LOCATION: *spearfish*, and MAPSET: *sample*). This location and mapset were used to enable the user to replicate the examples in this tutorial. However, you may substitute your own location and mapset for the spearfish location and sample mapset if you wish. Similarly, for the purposes of this tutorial, the full pathname leading to our spearfish sample database is: **/home/grass/data/spearfish/sample**. Your database may be installed in a different location on your system. If you install your database in a path other than this one, change the pathnames appropriately where they are used throughout this tutorial.

Commands to be entered by the user will appear in **bold** type. Variables that the user should specify (i.e., file names, pathnames, device names, etc.) will appear in *italics*.

In most cases, DLG-3 data will be supplied on 1/2-inch magnetic tape(s) at a density of 1600 bytes per inch (bpi). (We will assume this to be the case in this tutorial.) The DLG-3 data will be stored in a file on the tape. In most cases, there will be only one file per tape. However, there may be several files or even several tapes depending on the scale, the size of area covered, and the number of features requested by the user. A tape purchased from the USGS containing DLG-3 hydrography and transportation data at a scale of 1:24,000 will generally contain two files; a tape with DLG-3 hydrography and transportation data at a 1:100,000 scale purchased from the USGS may contain up to thirty-four files. Whether you have one file or several files to be extracted, the procedure is the same. The GRASS extraction program processes one file at a time. If several files need to be extracted, the program simply needs to be run several times by the user.

Along with the DLG-3 data, there should be some accompanying information either written on the tape spool or on an enclosed memo. Included should be values for tape density (generally 1600 bpi, but sometimes 800 or 6250 bpi); physical block size, sometimes referred to as block size or block (usually having a value of 4800, but sometimes having values of 1200, 2600, 5120, or 9600); logical block size,

sometimes referred to as record length (with values usually of 80); and the number of files on the tape.

3. SETTING UP THE USER'S ENVIRONMENT

Enter GRASS by typing the command:

grass4.0

and enter the appropriate *LOCATION* and *MAPSET*. Move into the *dlg* directory, a subdirectory of your mapset, by typing:

cd /home/grass/data/spearfish/mapset/dlg

If the *dlg* directory does not exist, create the directory with the command:

mkdir /home/grass/data/spearfish/mapset/dlg

and then move into the *dlg* directory.

4. EXTRACTING DLG-3 DATA FROM TAPE

Load the tape containing the DLG-3 data onto a tape drive and assign the appropriate density. The user should be familiar with the tape drive being used. On Concurrent machines, enter either of the following two commands (which one is used is dependent on your system set up):

assign 1600 or **assign 1600x**.

If you are working on a SUN machine, the tape density will be set automatically. Generally, the appropriate tape density will be 1600 bpi. The density value should appear on the tape spool. Once the tape is loaded and the density assigned, you are ready to extract the DLG-3 data from tape using the UNIX command **dd**. The command used to extract DLG-3 data from tape (with all its options) is stated below:

dd if=*tape_drive* **of=***output_file* **ibs=***block_size* **cbs=***conversion_buffer_size* **conv=unblock**

Here, the user should substitute the name of a specific tape drive device for the *tape_drive*, and supply a specific output file name for the *output_file* on the command line above. Similarly, the physical block size of the data on tape (usually written on the tape spool) should be substituted for the *block_size* above, while the *cbs* should always be set to 80, and the *conv* should always be set to unblock. (The above command is shown on two lines due to lack of space. Note, however, that the user should type this command on a single line.)

******** Note *********

Data can be stored on tape in several different ways. Here, the UNIX **dd** command was used for tape interaction, because it reads 1/2-inch tapes in their simplest form. It is generally easier for the supplier of a DLG file to produce DLG tapes in a basic tape storage format, rather than in such specific tape storage formats as **tar** or **cpio** (both of which are UNIX commands and tape formats). If you receive a DLG-3 tape in **tar** or **cpio** formats, follow this tutorial until you reach the instructions on tape extraction. Then, consult the UNIX manual entries on the use of the **tar** or **cpio** commands. Extract the data from tape and place it into the *dlg* directory of your mapset. Then, continue with section 4 of this tutorial.

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Given a tape with the following parameters,

```
if   = /dev/rmt0
of   = roads
ibs  = 4800
cbs  = 80      /* the cbs should always be set to 80 */
conv = unblock
```

the command :

dd if=/dev/rmt0 of=roads ibs=4800 cbs=80 conv=unblock

will extract the data from tape (the *input file* specified by /dev/rmt0), and place it in the *output file* "roads" located in the *dlg* directory of your mapset. The tape is not erased or altered in any way; it is simply copied.

5. CONVERTING THE DLG-3 FILE INTO GRASS VECTOR FORMAT

Under your mapset, there are several directories. At this stage we are concerned with four of these directories: *dlg*, *dig*, *dig_plus* and *dig_att*. (For a review of GRASS vector files, consult the GRASS document: *Vector Data in GRASS*.) Thus far, you have copied the DLG-3 data from tape and stored it in the *dlg* directory. This data is in DLG-3 format, which is now used only as an import format in GRASS. You therefore now need to convert this data to **vector form** using the GRASS command *v.import*.
Type the command:

v.import

You will be prompted with the following screen:

```
        Imports to GRASS Vector Format and Creates Needed Support Files

    1  -  Ascii DLG file  to GRASS Vector Format
    2  -  Binary DLG file to GRASS Vector Format
    3  -  Ascii VECTOR file  to GRASS Vector Format
    4  -  Binary VECTOR file to GRASS Vector Format


    Enter a number <1-4>
    anything else to quit:
```

Imported DLG-3 data will almost always be in ASCII form. Choose menu item #1.

Your next prompted with:

```
During the DLG-3 file conversion to Vector:
Determine if this map is composed of Area or Line information.
Do you want to give precedence to Areas (opposed to Lines) (y/n) [y]
```

A DLG-3 file may contain area features, line features, or a combination of the two. It is best to identify here the type of features contained in the DLG-3 file. If the file contains both Area Edges and Lines, accept the default value.

```
During the building of the Vector format:
Do you want to snap nodes to other nodes within a threshold (y/n) [n]
```

Answering **yes** to this question will cause any two (or more) nodes that are within a user-specified snapping threshold distance of one another to be considered as the same node. You may wish to do this, depending on the accuracy of the original data and the resolution of the final raster file.

6. EDITING AND/OR LABELING

Depending on the source and condition of the data, it may need to be edited and/or labeled. If this is the case, you will need to use the GRASS program **v.digit**. The **v.digit** program contains all the tools needed to edit vector data files. For further information about the use of **v.digit** see the *GRASS 4.0 Map Digitizing Manual: v.digit*. In this example, we will assume that the data either has already been edited/labeled, or does not need to be edited/labeled.

7. GENERATING THE RASTER MAP LAYER

Your next step is to create a raster file. Raster files are created from vector files based on the positioning of the current region. Only data that falls within the boundaries of the current region will be converted to raster form. It is therefore important that you set your current region so that it will contain all desired vector data. Use the GRASS commands **g.region** to adjust your current region. Once a region is set during a GRASS session the region values will remain set until they are changed. Convert the vector file to a raster file using the program **v.to.rast**.

At the command line, type the command:

v.to.rast

Although the conversion process is non-interactive, the program will write certain messages to the screen as it acts. You can run this program in the background by using the UNIX commands

cntl Z <RETURN>
bg

When the GRASS prompt reappears, the new raster file will be completed.

8. CREATING SUPPORT FILES FOR RASTER DATA

Raster files need supporting information. When a raster file is created, it contains no category, color, or history information. This information is supplied by the user, and can be entered using the GRASS command **r.support**. Do this now by entering at the GRASS prompt:

r.support

The **r.support** program will query you with the following:

Edit the cell header file for [file name]? (y/n) [n]
Update the stats for [file name]? (y/n) [n]
Edit the category file for [boundary]? (y/n) [n]
Create/Update the color table for [boundary]? (y/n) [n]
Edit the history file for [boundary]? (y/n) [n]

The program used to convert the vector file to raster format has already created an appropriate header file for the map layer. Editing the "cats" file allows you to enter category headings for each category. Making a new "colr" file allows you to choose a color scheme for the map layer. Editing the "hist" file is strongly recommended in order to provide some history information on the map layer. Included in the history file should be the source of the map, the name of the person or contractor that created the map, the date the map was created, and any problems or additional information particular to this layer. The history information will provide information to future users. You may run **r.support** as many times as desired, to update or alter information associated with the raster file.

Now a complete raster file representing the DLG-3 data should exist in your mapset. Check the raster file by displaying it and running **r.report**. If the raster file appears to be OK, remove the copy of the DLG-3 file located in the *dlg* directory. All GRASS programs access either raster files or vector files. DLG files are now used only for importing data into GRASS. Move into the *dlg* directory and enter the command:

rm *file_name*.

NOTE

If more than one file exists on the tape from which you are extracting the data, you will need to position the tape at the beginning of the desired file. This is done using the UNIX command **mt**.

To get a listing of the files on a tape along with their block sizes, run the GRASS command **m.examine.tape**.

REFERENCES

Ruiz, Marilyn S., and Jean M. Messersmith, *Cartographic Issues in the Development of a Digital GRASS Database*, USACERL Special Report N-90/16 (U.S. Army Construction Engineering Research Laboratory [USACERL], September 1990).

Westervelt, James, and William D. Goran, *Introduction to GRASS 4*, Draft ADP Report (USACERL, July 1991).

Westervelt, James, Mary Martin, and Deborah Brinegar, "GRASS 4.0 Programs," in *GRASS User's Reference Manual*, ADP Report N-87/22 rev (USACERL, September 1988, last revised December 1991).

Westervelt, James, Michael Shapiro, William D. Goran, et al., *GRASS User's Reference Manual*, ADP Report N-87/22 rev (USACERL, September 1988, last revised December 1991).