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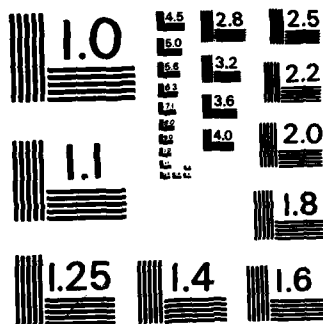
GRAFIT: A DICOMED EXTENSION (U) NAVAL RESEARCH LAB
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GRAFIT: A DICOMED EXTENSION

GENERAL

The GRAFIT package of subroutines for paper plots, Calcomp Incremental Plotter, the Tektronix and the Stromberg Carlson SC4020 is described in NRL Memorandum Report 4027. Subsequently, an interface was added to GRAFIT for the DICOMED. As listed in the above report some of the GRAFIT Subroutines are called directly by the user and are described in detail. Other subroutines perform specialized functions and are not called directly by the user. The entry points described for user interest are:

TEKSET - Set FOCUS, DEFOCUS and special lines.
DRWDMP - Flush DRAWA and MOVEA Buffers.

Most of the DICOMED and Tektronix subroutines fall in the not called by user category. However, these subroutines are listed for LINKAGE EDITOR information purposes.

AOUTST - Multiple Character String to Tektronix.
A1OUT - One Character String to Tektronix.
ALFMOD - Return Tektronix to Alpha Mode.
DEVDRW - Issues plot instruction to device dependent routines.
DEVPNT - Command Draw a Point.
DEVGEN - General ENDPOINTS With Pen Status.
DEVSEG - Segments Plots (VLINE Type)
DEVEND - Close Devices.
DICBUF - Check Bounds for DICOMED.
DICCHK - Check DICOMED Buffer for Overflow.
DICCHG - Set Warning Message Flag.
DICMED - Initialize DICOMED.
\$COLOR - Set Color.
DLINE - Low Level DICOMED Line Draw Routine.
DPNT - Draw Points.
DGEN - General With Pen Status.

DSEGMT	- Draw Line Segments (VLINE Type).
DICFRM	- DICOMED Frame Advance in Buffer.
DICFRW	- DICOMED Frame Advance into output file.
DICREC	- Change DICOMED Record Length To 72 Bytes.
DICDMP	- Flush Buffer to Output Unit.
DICADD	- Pipeline into BUFFERS.
DRAWA	- Tektronixs Emulator Draw Line (BUFFERED).
MOVEA	- Tektronixs Emulator Move Cursor (BUFFERED).
APOINT	- Place N Points on a Page.
ASEGMT	- Draw N Line Segments (VLINE Type).
ERACE	- Erase Tektronixs Screen.
INITT	- Initialize Tektronix.
HRDCPY	- Copy True-False Switch.
TEKCPY	- Reprint Current Frame.
HDCOPY	- Issue Hard Copy Command.
SWINDO	- Sets screen window viewing Simulator Plot-10.
VWINDO	- Sets screen window viewing Simulator Plot-10.
OUTADE	- Tektronix Output ASC II Look-up.
OUTDIC	- Write DICOMED Buffer to Unit.
PAKDIC	- Packs DICOMED Buffer.
DICEND	- Close DICOMED Output.
DICONM	- Select Output File Name.
POINTA	- Simulator Plot-10 POINTA.
SETINT	- Set Color Intensity.
DICCLR	- Puts Color Command into DICOMED Buffer.
TOUNIT	- Scales from Screen Units to Device Units.
TEKBUF	- Converts float to fix and bound.

TEKWRT	- Writes Tektronixs Output.
TLINE	- Low Level Tektronix Line Draw Routine.
TPOINT	- Draws Points.
TGEN	- General with pen status.
TSEGMT	- Draw Line Segments (VLINE Type).
IOWAIT	- Add Nulls to Buffer as Time Delay.
TSEND	- Aligns Next Word on New Record.
TOUTST	- Pipeline into Buffer.
TEKDMP	- Flush Tektronixs Buffer.
TEKRES	- Set Resolution.
TBELL	- Controls Bell During Hardcopy.

TEKSET

Purpose: To focus or defocus, or set resolution of Tektronix on 4014 or 4015 with enhancement module.

Usage: Call TEKSET (I1, I2)

Description of Parameters:

- I1 Integer - Primary function to be performed such as FOCUS, DEFOCUS, BELL or RESOLN.
- I2 Integer - Secondary function to be performed such as 'NORM', 'DOT', 'DOTD', 'SHORT', 'LONG', numerical or alphanumerical value.

Method:

The secondary operation NORM, DOT, DOTD, SHORT or LONG is processed through FOCUS or DEFOCUS routine as specified by I1.

When it is "RESOLN" the resolution is set to value specified by I2. This value is numerical 4096 or 1024. The 1024 may be entered as numerical or alphanumerical. If the value entered is other than 1024 the subroutine uses 4096.

When it is "BELL", the numbers of bells sent during a hardcopy is given by numerical value I2, where $0 < I2 < 6$.

DRWDMP

Purpose: To dump any partial Buffer.

Usage: CALL DRWDMP

No Parameters.

Method:

Through a series of internal calls Buffers for Tektronix and DICOMED are processed to lower level Buffers.

CHANGES

The user will encounter some procedural differences between the DICOMED GRAFIT extension and the other plot media. Below is a list of changes important to the programmer.

1. The GRAFIT program that contains the latest revision is on NEWLIB.
The path is:

USERCAT/D77/L50/NEWLIB.

2. The OTAPE number must be > 200 (see Appendix A).
3. The Output Tape must be nine track 1600 BPI. DOCUMENT NCN203 gives detail information on how to process tapes.
4. The DICOMED default Buffer is a 3600 word common block in GRAFIT.
5. The DICOMED Buffer automatically flushes when full therefore, one may get only a partial second and higher frame when a multiple frame sequence is attempted.
6. In the GRAFIT mode calls (see Appendix A) GRAFIT 4 may precede GRAFIT 2 when a frame advance is desired.
7. The DICOMED does not have an ORANGE filter. If an ORANGE filter is requested by call GRAFIT (6,...) a derived orange will be substituted.
8. GRAFIT 1 does not select DICOMED Buffers.

FIX UPS

1. The DICOMED has seven color filters; CLEAR, RED, GREEN, YELLOW, BLUE, PURPLE, TURQUOISE whose intensity or exposure may vary from zero (not used) to 255 (full intensity). The colors may be mixed, by overdrawing a previous color, to obtain derived colors. This is of special interest to a user who wishes to know how orange was derived to maintain compatability with SC 4020 and would like to produce additional colors.

The filter colors are arranged in an array sequenced as shown above. A common block array holds the corresponding intensity level for each color, i.e.

COMMON/DICCOL/INTCOL(8)

An ORANGE has been derived from the following code. Note: The call to DRWDMP must be made before changing colors. With this insertion the GRAFIT 6 call is OMITTED.

CALL DRWDMP

```
DO N I = 1,7
N INTCOL(I) = 0
INTCOL(2) = 255
INTCOL(3) = 96
```

For other colors or intensities similar combinations may be coded. GRAFIT 6 may be called for full intensity filter colors.

2. To change the size of the default Buffer which is in COMMON the user must give another common block the same name with larger dimensions (multiple of 1800) and set MAX to the new Buffer length. The default Buffer is:

```
COMMON/DICCOM/DICRAS(4), NEXT, MAX, OFFSET, BUFFER (3600).
```

To double the Buffer size we could use the following:

```
COMMON/DICCOM/DICRAS(4), NEXT, MAX, OFFSET, BUFFER (7200).
```

```
MAX = 7200.
```

3. Although the DICOMED Buffer is not designated by GRAFIT 1 as for the SC 4020, one may still have multiple Buffers. This is done by use of the TI LOC function. If one defines a Buffer of different length than the primary Buffer or does not invoke GRAFIT 1 before each use then it is necessary to save NEXT, MAX, and OFFSET for each Buffer. A second Buffer with length a multiple of 1800 may be defined as follows:

```
INTEGER BUFFER, DICBUF, OFFSET, OFFSAV
```

```
COMMON/DICCOM/DICRAS(4), NEXT, MAX, OFFSET, BUFFER (3600)
```

```
INTEGER DICTMP(7), DICBUF (5400)
```

```
NEXTSV = NEXT
```

```
MAXSAV = MAX
```

```
OFFSAV = OFFSET
```

```
NEXT = 1
```

```
MAX = 5400
```

OFFSET = LOC(DICBUF(1)) - LOC(BUFFER(1))

Each time an access to Buffer is requested the actual access is performed in DICBUF. One may revert to using Buffer simply by restoring NEXT, MAX and OFFSET. When the Buffers are the same length, GRAFIT 1 is to be called and the auxiliary Buffer contents are not needed one may simply zero OFFSET (i.e., OFFSET = 0).

4. The user may use entry TEKSET to FOCUS or DEFOCUS normal lines, DOTTED lines, DOT-DASH lines, LONG DASH lines and SHORT DASH lines. The resolution may be set to 4096 for Tektronix with the enhancement feature.

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APPENDIX A — MODES OF GRAFIT

In this description the Stromberg-Carlson 4020 will be referred to as the Stromberg or simply as S; the Calcomp Incremental Plotter will be referred to as the Calcomp or simply as C; the DICOMED D48 film recorder will be referred to as DICOMED or simply as D; the page plotter will be referred to as page or simply as P; the Tektronix CRT plotter is referred to as T. The GRAFIT subroutine is called by

CALL GRAFIT (MODE, OTAPE, BUFFER, STUFF)

Description of Parameters:

MODE	INTEGER	Designates operation to be performed
OTAPE	INTEGER	If equal 0(zero), do page plot; if negative do Calcomp plot (on logical unit 59), if between 100 and 200 do plot for Tektronix and put output on FTNNF001 where NN = OTAPE-100; if greater than 200 do plot for DICOMED and put output on FTMMF001 where MM=OTAPE-200; otherwise, use positive integer as Stromberg tape output logical unit number. Up to five separate tape unit numbers may be used simultaneously for the Stromberg.
BUFFER	INTEGER	Intermediate storage area for Stromberg instructions. (Note: C and P Buffers are fixed internal to GRAFIT).
STUFF	INTEGER	Used for frame ID, Data, etc.

The structure of GRAFIT is such that the calling program may be set up for its final usage of DICOMED or Stromberg plots while initially the program flow can be checked with page, Calcomp or Tektronix plots. The advantage of this is that one can immediately get an idea of the plot layout without waiting for a film to be processed. While a page plot is faster for the initial trials, a Calcomp plot gives more details and accuracy. The closest resemblance to the SC 4020 is the Tektronix CRT

plotter which is set up as a 768x768 raster point plotter. It is also faster than the Calcomp pen plotter. It must be noted however, that page, Calcomp and Tektronix plots are relatively slow, thus fewer plots should be made than with Stromberg which utilizes vectorized computer code. Frequently movies are made on Stromberg which require two or more printings of the same frame. If one provides that multiple frames be allowed only when OTAPE is between zero and 100 the program can be expeditiously checked without multiple output.

The feature which allows the versatility to GRAFIT is the variable MODE. Each medium, S, C, D, P, or T is assigned functions by MODE that it can perform. For example, P cannot change colors or filters, therefore, this function is bypassed except to note that a particular color or filter was selected. Appendix B gives a concise description of operations for each medium for the various values of MODE.

To use GRAFIT an initialization call must be issued for each output; i.e., S, C, D, P, or T. An attempt to use an output medium before initialization results in an error printout of non-initialization for S, C, D, P, or T as determined by OTAPE.

Therefore, the first call to GRAFIT must be an initialization call (MODE = 0).

MODE = 0.

Call GRAFIT (0, OTAPE, BUFFER, 'PPD E. DENT #.')

1. If OTAPE = 0, Initialize page plot (P).
2. If OTAPE < 0, Initialize Calcomp plot (C).
3. If 0 > OTAPE < 100, Initialize Stromberg plot (S).
4. If 100 < OTAPE < 200, Initialize Tektronix plot (T).
Output is on logical unit (OTAPE-100).
5. If 200 < OTAPE <, Initialize DICOMED plot (D). Output
is on logical unit (OTAPE-200).

For OTAPE = 0, a message is printed out that page plot initialized PPD E. DENT #. Otherwise, a frame is generated with NRL in large letters and PPD E. DENT is printed in lower right corner. For S we may generate additional identical frames by pairs of calls to GRAFIT with MODE = 3 and MODE = 4.

MODE = 1. BUFFER INITIALIZATION

Call GRAFIT (1, OTAPE, BUFFER, LBUFF)

This call must be done for S, D, and P to initialize the BUFFER COUNTER which contains the location of the last filled word in the BUFFER. For S the location of BUFFER and its length LBUFF is saved within GRAFIT. The location of the last word to be used is stored (saved) in BUFFER (1).

It is obvious that this call must be made before any call that uses the BUFFER area. This call must also be made after a call with MODE = 2 prior to storing additional information in BUFFER. For P the print area is set to blanks surrounded by broken lines. Additionally this call must be made at the end of each graph otherwise the new plot will be superimposed on the earlier plot.

MODE = 2. BUFFER PACK

Call GRAFIT (2, OTAPE, BUFFER, 0)

This call must be done for S and D. It has no effect on C, P and T. Information in BUFFER is packed into a continuous string of Stromberg 36-BIT or 32 BIT DICOMED instructions. Thus the "holes" which are left during generation of the instructions are closed.

MODE = 3. WRITE OUT FRAME

Call GRAFIT (3, OTAPE, BUFFER, 0)

Writes out P, D, and S, has no effect on C or T. This write is non-clearing for P and non-reset for S and D. By holding the BUFFER intact more than one frame can be made for movies. P and D non-clearing allows a view of a partial graph where further plots will be superimposed.

MODE = 4. FRAME ADVANCE

Call GRAFIT (4, OTAPE, BUFFER, STUFF)

Advances the film for S, inserts a film advance command in BUFFER for D, or advances the paper for C. There is no effect on P. If STUFF (1) is greater than or equal to zero, the first 3 characters passed by STUFF when

MODE = 0 is written on the lower right side of each frame. For the Tektronix, hard copy is generated and the screen is cleared. If no hard copy is wanted the hard copy unit may be turned off. After the hard copy and erase commands are issued, "FRAME nnn" is written on the screen where "nnn" is the frame number of the previous frame. A frame directory can therefore be obtained through a "find string all" (FSA) command on the word "FRAME".

MODE = 5. CAMERA SELECT

Call GRAFIT (5, OTAPE, BUFFER, STUFF)

A camera select command is issued for S; there is no effect on C, D, P, or T. The camera is selected according to the following integer value in STUFF (1).

- 1 = Camera 1 (hard copy)
- 2 = Camera 2 (35mm or 16mm)
- 3 = Camera 1 and camera 2

A camera remains selected until a new camera select command is issued. Generally the camera selection is a manual operation on the S-C 4020. Specific instructions must be given to the S-C 4020 operator to allow the plotting tape to select cameras under program control.

MODE = 6. COLOR SELECT

Call GRAFIT (6, OTAPE, BUFFER, 'Colors')

Selects the colors for S and prints the color selected. Only print the color selected for C, D, P, and T. After ten frames no print is made for C, D, P, or T. The colors are: CLEAR, RED, ORANGE, YELLOW, GREEN, TURQUOISE, BLUE and PURPLE. The colors may be entered as shown but only the first four letters are used and must be exactly as shown (for RED three letters are sufficient). Orange is synthesized by a combination of colors on DICOMED, and thus takes longer to draw.

A restriction is placed on the use of colors by the hardware used to change color on the Stromberg-Carlson. A check of the actual position of the color wheel can only be made for CLEAR. To avoid hardware problems, it

is strongly suggested that CLEAR be selected at the beginning and end of every frame. For maximum efficiency the sequence of colors used within a frame should follow the actual color sequence on the color wheel being used.

MODE = 7. FILTER SELECT

Call GRAFIT (7, OTAPE, BUFFER, 'Filter')

Selects the FILTERS for S and prints the filter level selected. Has no effect for D. Prints the filter level for C, P, and T; after ten frames no print is made. The filter levels are CLEAR, 2 LE, 3 LE, 4 LE, 5 LE, 6 LE, 7 LE, and 8 LE (Note a space is the second character in levels after CLEAR).

Filter levels used may be full word data items using four characters. Thus CLEAR becomes CLEA.

MODE = 8

Call GRAFIT (8, OTAPE, BUFFER, ARG)

For S and C ARG is a real number, REALNO; REALNO is the number of frames to advance for S, and a multiplicative factor for the length of the x-axis for C. For the Tektronix ARG is an integer. It has no effect on P or D.

Normally one film frame is advanced for each call to GRAFIT 4. However, there are times when it is desirable to isolate plotted frames. A call to GRAFIT (8,...) with REALNO greater than zero sets an internal counter for the number of additional frame advance commands to be issued on the next call to GRAFIT (4,...). The counter is just REALNO rounded to the next highest integer. Therefore $1 > \text{REALNO} \geq 2.0$ will cause GRAFIT (4,...) to insert one blank frame and $2. < \text{REALNO} \leq 3.0$ will cause two blank frames to be inserted. Up to five additional blank frames may be inserted in this manner.

The length of the x-axis for C is 11 inches and the increment is 0.01. The length of the x-axis may be increased by REALNO up to a factor of two. At two the increment is changed to 0.02.

In both S or C no change is performed for a zero. However, an error message is noted on the printed output.

For the Tektronix call GRAFIT (8, OTAPE, BUFFER, - 1) will reset the screen correspondence to 1024 x 1024. Since the physical screen is only 768 high, the top quarter is lost in this mode. However, the right portion of the screen is now addressable. Note that in this mode the last argument is an integer.

MODE = 9.

Call GRAFIT (9, OTAPE, BUFFER, 'PPD E. DENT #.'))

The BUFFERS are flushed for S, D, C, P, or T. In addition, for S the frame count is printed and reset, the color and filter is reset to clear, and end-of-file written on tape. For C ENDPLT is called. For T, the cursor is reset to the upper left corner.

APPENDIX B - SUMMARY OF MODES

MODE

Integer designator of function to be performed (where C, P, and S denote the action taken for CALCOMP. Page and Stromberg plots respectively, T indicates action taken for a tektronix CRT terminal, and D indicates action taken for the DICOMED).

- 0, Initialize and print necessary identification
 - C - Advance after initializing
 - P - Write Heading
 - S - Call DRWNRL and advance afterward
 - T - Initialization clear screen. Set CRT to Graphic Mode
 - D - Select vector mode and neutral color
- 1, Set up for single graph and return
 - C - Has no effect
 - P - Clean the page
 - S - Set the buffer counter
 - T - Clears the screen
 - D - Reset buffer pointer to indicate empty buffer
- 2, Pack the buffer, if necessary
 - C - Has no effect
 - P - Has no effect
 - S - Pack the buffers in place
 - T - Has no effect
 - D - Packs the buffer
- 3, Write out the plotting commands
 - C - Has no effect, call advance after
 - P - Prints the page but does not clear
 - S - Writes out the tape from buffer
 - R - Has no effect
 - D - Write buffer to tape, does not empty buffer
- 4, Advance film or paper
 - C - Film advances
 - P - Has no effect
 - S - Film advances, frame ID in STUFF(1)
 - T - Issues a hard copy command
 - D - Writes film advance command into buffer
- 5, Perform a Camera select
 - C - Has no effect
 - P - Has no effect
 - S - Selects camera in STUFF(1)
 - T - Has no effect
 - D - Has no effect

- 6, Color selection for GFDL Stromberg Method
 - C - Has no effect
 - P - Prints the select command
 - S - Selects the desired color
 - T - Has no effect
 - D - Selects the desired color

- 7, Filter selection for GFDL Stromberg Method
 - C - Has no effect
 - P - Prints the select command
 - S - Selects the desired filter
 - T - Has no effect
 - D - Has no effect

- 8, ABSCISSA change for plot
 - C - Initializes the length of x-axis
 - P - Has no effect
 - S - Number of frames to advance
 - T - STUFF(1)--1 sets screen correspondence to truncation of the top quater.
 - D - Has no effect

- 9, Close out the plotting and flush buffers
 - C - Plots end and terminates
 - P - Writes out page with termination
 - S - Plots end and terminates
 - T - Terminates the plot routines
 - D - Dumps buffer to Tape, closes output file