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User's Guide for Department 9140 CAE Workstations

David E. Salguero

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User's Guide for Department 9140 CAE Workstations

David E. Salguero
Advanced Systems Development Department
Sandia National Laboratories
Albuquerque, NM 87185

Abstract

The purpose of this report is to provide some basic information to beginning users of Department 9140's Computer-Aided Engineering (CAE) workstations. These workstations are all Digital Equipment Corporation (DEC) color VAXstations, and they use the VAX/VMS operating system. This manual shows users how to boot the workstations, login, use the window interface, and use some basic VMS commands. It also discusses some of the CAE software available on the workstations, such as ANVIL-5000. References are given so users can get additional information.

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1. Introduction

The purpose of this report is to provide you with some basic information on how to operate the Computer-Aided Engineering (CAE) workstations available in Department 9140. It assumes that you know little about computers or workstations. Some of the software available on the workstations is also discussed. Before getting into the details of how to use a workstation, some background information is given that you may find interesting.

History

In the 1985-1986 timeframe, Department 9140 decided to purchase computer equipment for Computer-Aided Design (CAD) to improve the productivity of the mechanical designers. The initial emphasis was for CAD applications; however, there was also a need for improved computer equipment for analysis. During this timeframe, designers in Department 9140 were performing all of their tasks manually on drafting boards, and analysis was performed on a time-sharing VAX-11/780 system on inexpensive terminals. The use of computer graphics was limited.

In about the same timeframe, micro-computers were becoming powerful enough to be called "workstations". Workstations are stand-alone computer systems that can operate in an office environment and that have a larger processing capability than the original personal computers such as the IBM PC. The processing capability of workstations is between the PC's and the larger mainframe computers such as the Crays. Workstations vendors include Digital Equipment (DEC), Hewlett-Packard (HP), Apollo, Sun, and IBM. Workstations eliminate the need for time-sharing VAX systems with terminals.

Workstations have two advantages over classical time-sharing systems with terminals: (1) they provide high-speed graphics, and (2) they provide dedicated processing to a single user. High-speed graphics is important for CAD applications, for analysis applications, and for improved user interfaces. A dedicated processor is important because it guarantees response times since the machine is not shared with others. This lets you predict how long tasks will take to finish without concern for the load on the computer system. Workstations also give users the psychological benefit of feeling that they have more control over their computing resources.

Most VAX systems at Sandia are connected with a network allowing files to be transferred between systems. The network is also connected to the Cray mainframe

computers at the central site, so jobs can be sent to the Crays and results from the Cray can be sent back to the VAX's. The network is an important part of our computing capabilities, and any new computer equipment must be able to connect to it.

Nearly all of the available workstations in 1986 (and today) used the UNIX operating system, which was different from the VAX/VMS system used by the majority of distributed computers at Sandia. The UNIX operating system had security problems, so computers using it could not be easily connected to the Sandia secure network. This is still true today, although solutions to this problem will be available within the next year or two.

The only workstations that could be connected to the network easily were those produced by Digital Equipment Corporation (DEC). These workstations, called VAXstations, also had the advantage that they were completely software compatible with other VAX systems at Sandia. Any software that worked on other VAX systems worked on the VAXstations. Furthermore, VAX users could easily adapt to the VAXstations because the commands were the same.

The disadvantages of the VAXstations were that they did not have the processing capability of other workstations and that they were more expensive. We felt that the advantages of connecting to the network and software compatibility outweighed the price/performance problem, so we selected the VAXstation as the Department 9140 workstation. About three workstations per year were ordered from 1986 to 1988.

In 1989 we have added nine more workstations and formed a workstation "cluster". Clustering the workstations ensures software commonality, and it reduces the workload of the system manager. It also makes it easier for the workstations to share resources such as printers, plotters, and software.

In subsequent years we plan to continue purchasing workstations until a total of 20 to 24 is reached. We also plan to integrate Apple Macintosh computers into the network so files can be transferred between the VAXstations and the Macintosh systems. As Sandia moves towards UNIX systems, we will also be converting to UNIX workstations.

Hardware

For the most part, the VAXstations in the department are very similar. Each system has a MicroVAX central processing unit with a graphics co-processor. The VAXstation II/GPX and the VAXstation-2000 systems have the MicroVAX II processor, which is approximately equivalent to the VAX-11/780 processor. The

VAXstation-3100 and 3200 systems have the MicroVAX III processor, which is about three times faster.

The graphics co-processor provides high-speed graphics to the monitor, that is, it draws characters and lines quickly on the screen. On all machines except the VAXstation-2000 you can use up to 256 colors at a time; the VAXstation-2000 is limited to 16 colors at a time.

All of the systems have at least 7 megabytes of memory, and some have has much as 13 megabytes. Workstations with more memory run a little faster than those with less memory.

Each workstation also has at least one disk drive for permanent file storage. All information permanently stored in a workstation is on a disk. Disk storage capacity for each system ranges between 150 megabytes and 400 megabytes. This is much more than is typically available to each user on a time sharing VAX system.

All of the machines have a 19 inch color monitor, the standard DEC keyboard, and a mouse. The mouse is used to point to objects on the screen. Many of the new user interfaces for programs use the mouse to make them easier to use.

Many of the systems also have a cartridge tape drive called a TK-50. Tapes are used to install new software, backup files on disk, and to transfer files between machines not on the network.

All of the machines are connected to the network for unclassified processing. When connected to the network, files can be copied between workstations and between other VAX systems on the network. For example, files containing drawings can be sent to and from drafting and the shop. The network also lets the workstations share printers, plotters and disks.

Software

All of the VAXstations in the department have a common set of software available. For example, all of the VAXstations have a FORTRAN compiler, and they all have access to the DISSPLA graphics library and the IMSL, SLATEC and FXMATH mathematical libraries. One of the more important software packages available on all machines for mechanical design is called ANVIL-5000.

ANVIL-5000 was selected by Organization 2800 to be the "standard" mechanical design software at Sandia. It is used by drafting for making drawings and by the shop for numerical control programming. Since this software is available on the

VAXstations, we can create geometry files or drawings and send them to drafting or the shop. Similarly, drawings or geometry created by drafting and the shop can be copied from their machines over the network and checked on the VAXstations. Corrections can be noted and sent back.

We have a limited capability to make hardcopy drawings from ANVIL-5000 with a Hewlett-Packard pen plotter that can handle up to E-size paper. This plotter is somewhat slow and paper must be loaded for each drawing, so it is limited in its ability to quickly produce large numbers of drawings. ANVIL-5000 drawings can also be printed on several laser printers connected to the VAXstations and on a Calcomp color printer.

Other software available on all machines includes some developed at Sandia for aerodynamic analysis. Aerodynamic prediction codes such as Missile DATCOM, Sandiac, and SHABS are available, and trajectory analysis codes such as PMAST, TSAP, and AMEER are available. Other useful programs include an interactive graphics program based on DISSPLA called EGS, and a solid rocket booster program called ROCKET.

Some software is only available on a limited basis. This includes software for mechanical design and analysis, called IDEAS, that is much better than ANVIL for solid modeling and finite-element analysis. It is available on all workstations, but only two can use it simultaneously.

Another software package that is available on some of the workstations is called Interleaf. It can be used to make reports (such as this manual), viewgraphs, memos, and letters. It is a "what you see is what you get" type of program, so you can see on the screen exactly what your printout will look like. Figures, tables, and equations can be included as part of the document. Drawings from ANVIL-5000 and plots from EGS can also be incorporated into Interleaf.

Security

All except one of the workstations can only be used for unclassified processing. This is because they are connected to the network on circuits that are not secure and because they have disk storage devices that are not locked in a safe or vault.

Security rules on the unclassified workstations are relatively simple:

- You must use a machine-generated password with at least 8 characters
- You must keep your password stored as "Private" information
- You must change your password once a year
- You must logoff when you are finished using the workstation

The one workstation that can be used for classified processing has removable disks that can be stored in a safe and it must be operated stand-alone for classified processing (it cannot be connected to the network). Because of this, it does not have access to all of the resources (such as printers and plotters) on the network. This workstation has a security plan approved by Organization 2600, which lists the security rules for classified processing.

2. Getting Started

The unclassified VAXstations should be left turned on at all times except for the Christmas holidays and for maintenance. This reduces maintenance problems, and it lets others have access to your machine across the network.

Turning on a workstation

If you find that someone has turned off the power to your machine, you can turn it back on easily. This process is called "booting" your machine. First you need to turn on the monitor, printers, and any external disk drives, before turning on the processing unit. Then turn on the processing unit. The power switches are on the right-hand side of the monitor, on the front of the disk drives, on the front of VAXstation II/GPX systems, and on the back of VAXstation 3100 systems.

When the processor is first turned on, it performs a self-test of the processor, memory, and communications boards. During this test it may display some odd looking graphics followed by a countdown on the screen; for example,

```
7..6..5..4..        etc.
```

The hardware self-test only takes a couple of minutes, and the last hardware test is numbered "3". Then it starts loading the operating system software over the network. During the initial stages of this process, it displays the rest of the countdown, that is,

```
2..1..0
```

If you do not get this countdown, then you will probably see the following prompt:

```
7..6..5..4..3..

>>>
```

This means that the "auto-boot" switch on the back of your processing unit or in memory has been set to the "disabled" position. You should let the system manager know that it needs to be set to the "enabled" position.

To continue booting your machine, you need to enter a "B" for boot and a "carriage-return" from the keyboard; for example,

```
7..6..5..4..3..
```

```
>>> B

2..1..0
```

After the countdown is displayed, it takes about 5 to 10 minutes to load the operating system and get the workstation configured so you can login. Additional messages are displayed on the screen, but you can ignore them.

All of the system software and application programs are loaded from a special computer that manages the workstation cluster. This computer, called the "boot node", must be turned on and operating before you can boot your workstation. If the machine fails to boot, you need to check the status of the boot node.

When the operating system is installed, it clears the screen and displays a small box in the upper-right corner of the screen containing the date and a clock. At this point, it is ready for you to login.

Turning off a workstation

The easiest way to turn off a workstation is simply to turn off all of the power switches (to the processing unit, the external disks, the monitor, and the printer). This is the same as a power failure, and although there is some risk involved, we have not had any problems.

A better and safer way to turn off a workstation is to login and execute the shutdown command, that is,

```
$ SHUTDOWN
```

This command gracefully shuts down the operating system, and it performs some checks to be sure that it will startup again when you turn it back on. When this command finishes, it displays

```
SYSTEM SHUTDOWN COMPLETE - USE CONSOLE TO HALT SYSTEM
```

Then you can turn off the power to the workstation with no risk.

Rebooting a workstation

Occasionally a workstation quits responding to anything. This seems to happen only when running one of the CAD programs such as ANVIL-5000 or IDEAS. The only solution is to reboot the machine. This should be a last resort to get the machine working again, because you will lose any information that you have not previ-

ously saved. If this happens often (more than once every couple of months), you should let the system manager know about it.

On the VAXstation II/GPX and VAXstation-3200 systems, you do not have to turn off the power to reboot. You only need to press the button labeled "Restart/Run" located on the processing unit (on the VAXstation II/GPX you need to open the door on the lower-left front of the machine). This restarts the machine just as if you had turned the power off and back on. The VAXstation-2000 and VAXstation-3100 systems do not have a "Restart/Run" button, so you must turn the power off and then back on again to reboot.

Power failure

If a power failure occurs, the entire cluster must be restarted. The boot node must be turned on first. Then each workstation can be booted one at a time. This takes some effort to get all of them working again, but it prevents possible problems when several workstations try to boot at the same time. If the power fails, you should contact the system manager to find out when to boot your machine.

Before you login the first time

Before you login to a workstation for the first time, you need to have the system manager create an "account" for you. He assigns a user name and a password to you, and he sets up a directory for your files. He will need to know your initials and your employee number. This only takes about five minutes. Your account is valid on all CAE workstations in the cluster.

Your user name consists of the first letter of your first and middle names followed by the first five letters of your last name. It can have a maximum of seven characters in it. For example, the user-id of the author, D. E. Salguero, is DESALGU.

Your password can be assigned to you by the system manager, or it can be set to the same password you use on another VAX at Sandia. It must be a "machine-generated" password. These are random combinations of letters that are meaningless. You should never set your password to a word or name because these are too easy for someone to obtain. Your password for an unclassified workstation should be protected as "Private" information, and it should be changed once a year.

Logging in

Most workstations in the department are left turned on, so you will not need to boot the machine to use it. However, you always have to "login" to the machine before

you can use it. Logging into a workstation consists of creating a terminal "window", entering your user name, and entering your password.

VAXstations have a screen dimmer that automatically dims the screen if the machine is left inactive for more than 15 minutes (you can change this time period if you want to). So when you sit down in front of the monitor, the screen is normally blank or dim. To activate the screen, you just need to move the mouse a little. If you still do not see anything, you need to make sure that the monitor has power and that the contrast and brightness controls on the right-hand side of the monitor are adjusted properly. You should at the minimum see a box in the upper-right corner of the screen.

When the screen activates, you are ready to create a "window" which represents a terminal. A window is an area of the screen where things can be displayed. Anything that would normally be displayed on a terminal is displayed inside the window.

You start by moving the mouse to an open area on the screen (anywhere not inside the box in the upper-right corner), and pressing the left button. You should see the menu shown in Figure 1.

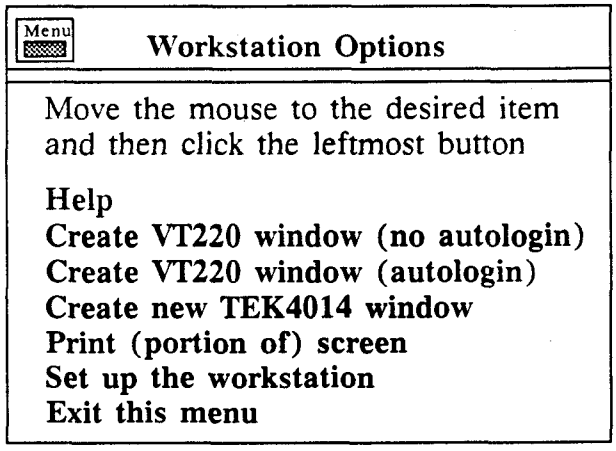

Figure 1. Workstation Options Menu

As you move the mouse pointer across the menu items, for example the "Set up the workstation" item, they are highlighted. You need to position the mouse so the first item, "Create VT220 window (no autologin)", is highlighted, and then press the left button to select.

If you selected the menu item correctly, a large area of the screen will appear as shown in Figure 2. The area along the top of this window is called the window

banner. The left side of the banner has a menu box, and the right side of the banner has a "keyboard active" indicator. The remaining part of the window acts as a terminal display. On most VAXstations, users setup the default terminal display area to show 80 characters per line and about 50 lines of information. When you

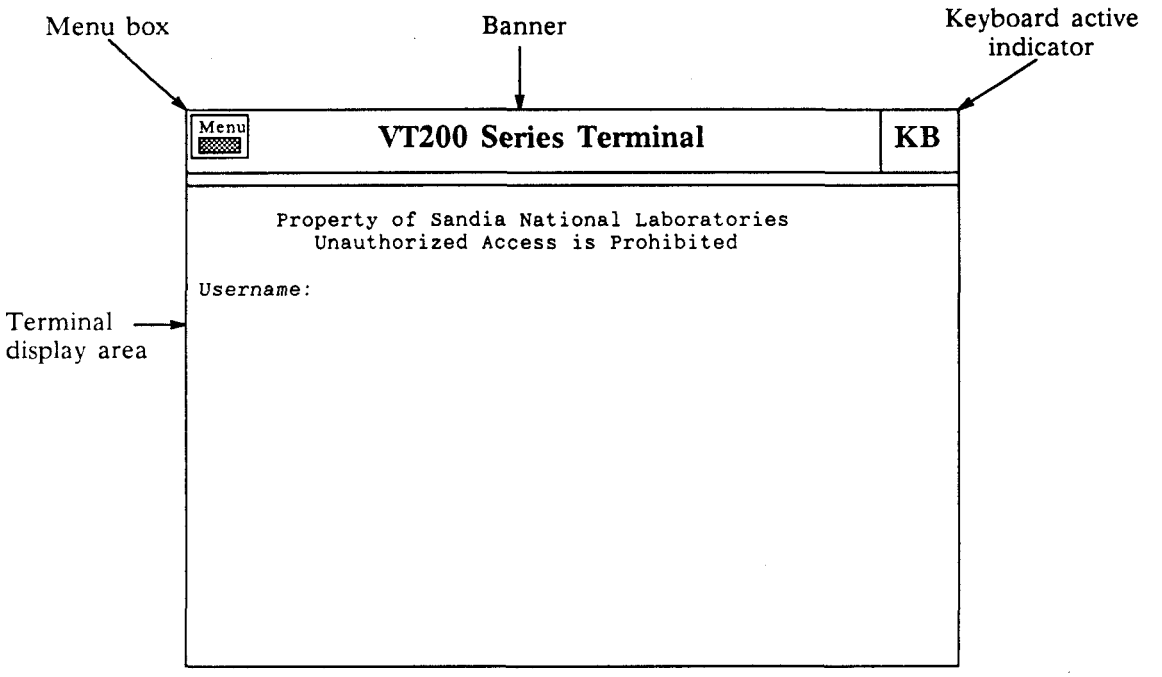

Figure 2. VAXstation Terminal Window

create a terminal window, you will be prompted for your user name as shown in Figure 2.

In response to the prompt, you need to type in your user name from the keyboard. After you have typed your name, you must press the "return" key to actually enter the name. The VAXstation will not accept the name until you press "return". You are only given about 20 seconds to begin entering your user name; otherwise, the window disappears. If this happens, you can create the window again by using the "workstation options" menu.

The next prompt is for your password. Your password is entered the same way as your user name except that the VAXstation will not display the characters as they are typed. You must be careful to type in your password correctly since you cannot see what you have typed. The password is not displayed on the screen for security reasons.

If you enter your user name or password incorrectly, then the VAXstation displays the message

```
User authorization failure
```

You can try again by pressing the "return" key to get the "Username:" prompt. The VAXstation will give you about 4 or 5 tries before de-activating your account. Then you will have to see the system manager for help. Again this is done for security reasons to protect your machine from unauthorized use.

If you enter your user name and password correctly, then the VAXstation displays some messages that end with a dollar sign in the first column of a line. The dollar sign is the VAXstation prompt for a command, and it indicates that you have successfully logged into the system.

A small blinking box is displayed immediately following the dollar sign prompt. This represents the text cursor. If you type something on the keyboard, the text is displayed at the cursor location.

An example of a login is given below, where the user name has been underlined to indicate that it was typed in by the user. The password is not displayed. Following the password are some messages, and finally the dollar sign is given.

```
        Property of Sandia National Laboratories
           Unauthorized Access is Prohibited

Username: DESALGU
Password: _______

  Welcome to MicroVMS 4.7 on VAXstation II/GPX

    Last interactive login on Monday, 13-FEB-1989  9:13
    Last non-interactive login on Friday, 10-FEB-1989  16:53

$
```

VAX commands

The dollar sign, as stated above, is a prompt for a VAX command. The VAX command language is called the Digital Command Language (DCL), and it is documented for VAXstations in Reference 1. Several copies of Reference 1 are available in the department. Some of the basic DCL commands are also documented in Section 4 of this report.

All DCL commands are typed in from the keyboard. As each key is pressed, the character is displayed in the terminal window following the dollar sign. The command is not actually accepted by the VAXstation until you press the "return" key. This means that you can use the cursor keys and the backspace key to easily correct any typing mistakes before pressing "return".

Most DCL commands consist of a verb, an object, and some optional parameters that begin with a slash "/". Some commands also require you to provide the name of one or more files.

If you want to try a DCL command, type in the following:

```
$ SHOW  TIME
```

In the examples shown in this manual, commands that you type are underlined. This command requests the VAXstation to display the current time and date. When you press "return" to send the command, the VAXstation displays something similar to

```
$ SHOW  TIME

  12-NOV-1988   09:39:21

$
```

After the command executes and displays the time and date, another dollar sign is displayed prompting you for another command.

Command recall

During a normal working session on a VAXstation, you use one or more DCL commands to run some computer programs or manipulate some files. When a dollar sign is displayed, the previous command has completed, and the workstation is waiting for you to enter another command. When you are finished with your work, you enter a special command to logoff of the workstation.

There are a couple of handy features available to you when you are entering commands. One of these is the capability to recall up to 20 previous commands. If you have entered a command, for example the "SHOW TIME" command, you can recall it by pressing the up-arrow key (normally used to control the cursor). The "SHOW TIME" command (or whatever the previous command was) is displayed following the dollar sign. If you just want to repeat the command, you only need to press the "return" key to enter it.

You can press the up-arrow key several times to recall other commands. Each time you press the up-arrow key, the next previous command is displayed. If you go too far back through the list of commands, the down-arrow key can be used to move forward through the commands.

Command editing

The ability to recall previous commands is useful for correcting typing mistakes made while entering the command. For example, if you entered

```
$ SHOQ  TIME
```

where "SHOW" has been spelled incorrectly, the VAXstation displays the error message

```
%DCL-W-IVVERB, unrecognized command verb - check validity and spell-
ing \SHOQ\
```

Error messages on the VAX always start with a percent sign, and they usually have a descriptive message. In this case it tells you to check the validity and spelling of the command, and it did not like the "SHOQ" part of the command.

To fix this error, you can type in the command again with the correct spelling; however, only one character in the previous command is wrong. So it is easier to recall the previous command with the up-arrow and then use the left-arrow key to move the cursor to the "Q". Then you can press the "W" key to correct the command and press "return" to enter the corrected command. This procedure is easier than typing in the whole command again.

When you press the "W" key to correct the bad character, the "W" replaces the "Q" character (it replaces whatever character is at the cursor location). If you wanted to insert the "W" in front of the "Q", then you need to get into the "insert" mode by holding down the "Ctrl" key and pressing the "A" key. This is called a "control-a" command, and it toggles the insert mode on and off each time you enter it. After you enter the control-a command, any characters that you type are inserted in the command line. To turn off the insert mode, you just enter another control-a command.

Use of the command recall with the up and down-arrow keys and use of the insert mode with the control-a command, make it easy to correct typing errors in commands. The command recall feature sometimes works inside application programs, but you need to consult the program's documentation.

Interupting or stopping commands

From the time that you enter a command by pressing "return" until it finishes and displays the next dollar sign, you can interupt or stop it from executing by entering a control-y or control-c command. These commands are entered by holding down the "Ctrl" button and pressing the "Y" or "C" key. The VAXstation responds by displaying the message "INTERUPT" and trying to stop the previous command from executing.

Setting your password

If you have an unclassified account on several VAX systems at Sandia, you can use the same password on all systems as long as it has at least eight characters and it is machine generated. You must contact the system manager, however, to get your password set to one used on another machine.

If you need to change your password because it has expired and if you do not have a password on another machine, then you can let the VAXstation generate some valid passwords for you with the command

```
$ SET  PASSWORD
```

This command produces a list of five valid passwords and lets you pick one of them; for example,

```
$ SET  PASSWORD
Old password:

  wafpuzeg    waf-pu-zeg
  afowxlad    a-fowx-lad
  fuafuds     fu-a-fuds
  noxawv      nox-awv
  plecarn     ple-carn

Choose a password from this list, or press RETURN to get a new list
New Password:
```

The machine-generated passwords are in the left column, and they are broken into syllables in the right column. You will have to enter one of the passwords in the list twice before your password is changed.

If you forget your password, you will have to get the system manager to set it for you. If you write your password on paper, be sure to store it as "Private" information.

Help commands

The VAXstations have some documentation stored on their disks that you can access with the HELP and SHELP commands. This information is somewhat terse, but it is better than nothing. The more you use the VAXstation and become familiar with the commands, the more useful the help commands are.

The HELP command displays information about the VAX DCL commands. It gives the command function (what it does) and its syntax (how you type it in). The command is interactive and self-explanatory. You just need to type

```
$ HELP
```

to get started and follow the displayed instructions.

The SHELP command displays information about special commands available on VAX's and VAXstations at Sandia (the "S" in SHELP stands for Sandia). It works the same way as HELP in that it is interactive. To start it working you just need to enter

```
$ SHELP
```

You can exit either help command at any time by entering a control-z command, that is, you hold down the "Ctrl" key and press the "Z" key.

Logging off

When you have finished your work, you need to logoff the workstation. This is very easy. All you have to do is enter the "LO" command, that is,

```
$ LO
```

This removes the terminal window and terminates your session. After you logoff, you can always login again to continue your work.

3. Workstation Software

VAXstations run the VAX/VMS operating system so they are compatible with all other VAX-type machines, but they also run some software controlling the windows called the "workstation software". The workstation software displays the menu that you use to create a terminal window, and it creates the window. It also lets you move the window, change its size, and create additional terminal windows. If you write computer programs, you can use the workstation software to control what is displayed inside windows.

The purpose of this section is to show you what you can do with the workstation software and how to do it. This section does not give all options available; it only gives those that are used most often.

You can use the workstation without this knowledge, so if you are a beginning user, you may want to skip this section for now.

3.1. Workstation setup

If you use the mouse to position the pointer in an empty area on the left side of the screen (not an area used for a window or box) and press the left button, the "workstation options" menu is displayed as shown in Figure 3. As shown in the previous

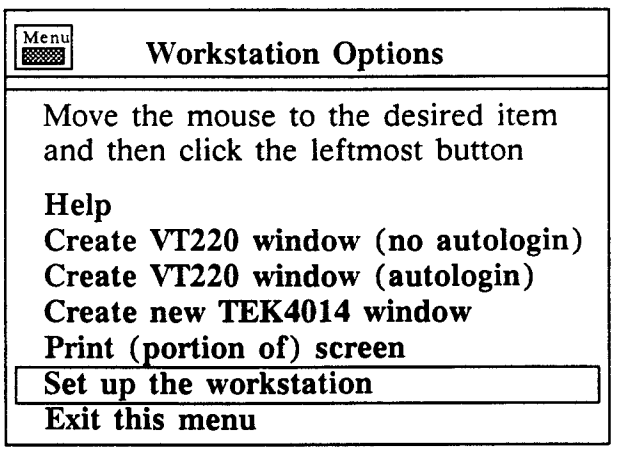

Figure 3. Workstation Options Menu

section, this menu is used to create terminal windows and to login to the system. It can also be used to setup workstation parameters and to print part of the screen.

The workstation parameters are used primarily to control the colors used for the display background and the windows. They also control the default window size and the keyclick and bell volumes. Many other workstation parameters can be adjusted with the workstation setup menues, but you should probably not change their values from the default settings.

To adjust the workstation parameters, you need to select the "set up the workstation" menu item from the workstation options menu shown in Figure 3. You can select this item by moving the mouse until it points to the line (the line will be highlighted) and pressing the left mouse button.

All menu selections in the workstation software work the same way; you move the pointer until the item you want selected is highlighted, and then you press the left-most mouse button. When you select the "set up the workstation" menu item, another menu, shown in Figure 4, is displayed.

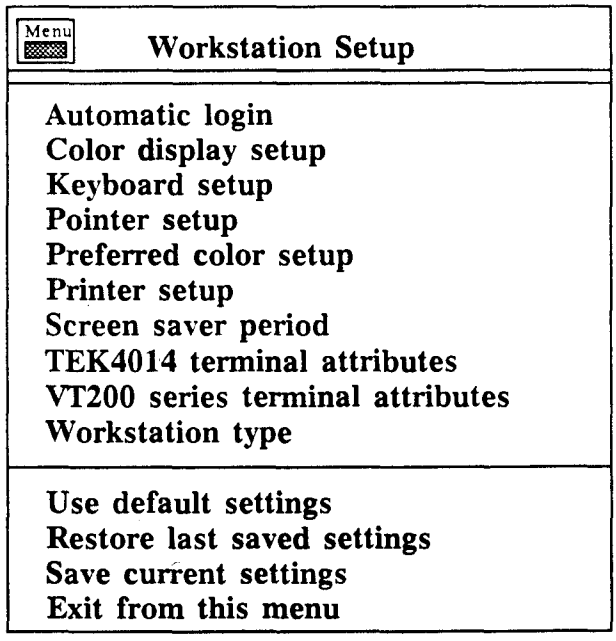

Figure 4. Workstation Setup Menu

The menu in Figure 4 lets you control many features of the workstation software. This manual will only discuss the more commonly used parameters. For more information you need to see Reference 2.

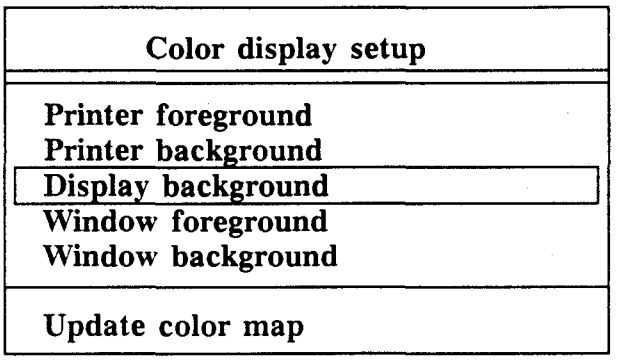

Figure 5. Color Display Setup Menu

Workstation colors

The colors used for the background, the pointer, and the windows are set by selecting the "color display setup" menu item. When you select this item, the menu shown in Figure 5 is displayed. This menu lets you change the color of the items listed, for example, the display background.

If you select the "display background" from the color display menu, a color "control panel" is displayed as shown in Figure 6. This panel lets you adjust the background color to anything you want by using the mouse. The current color is displayed just below the banner containing "Display background".

If you position the mouse pointer on one of the color control arrows, press the left button and hold it down, and move the mouse pointer horizontally while holding the button down, the color will change. The three color control arrows control the intensity of red, green, and blue so you can get any color.

When you move the control arrows, you only affect the color in the control panel. To update the display background, you must move the mouse back to the "color display setup" menu (which is still displayed) and select the "update color map" menu item. Then the background color is immediately changed.

The pointer and window colors are changed the same way. You must be careful that you set each item to a different color; otherwise, you will not be able to see what is displayed. The workstation software displays a warning message if it thinks you have selected colors that cannot be distinguished.

Bell and keyclick volumes

Some application software packages, such as ANVIL-5000 and Interleaf, make use of a "bell" or "beep" to warn you of an input error. You can control how loud the

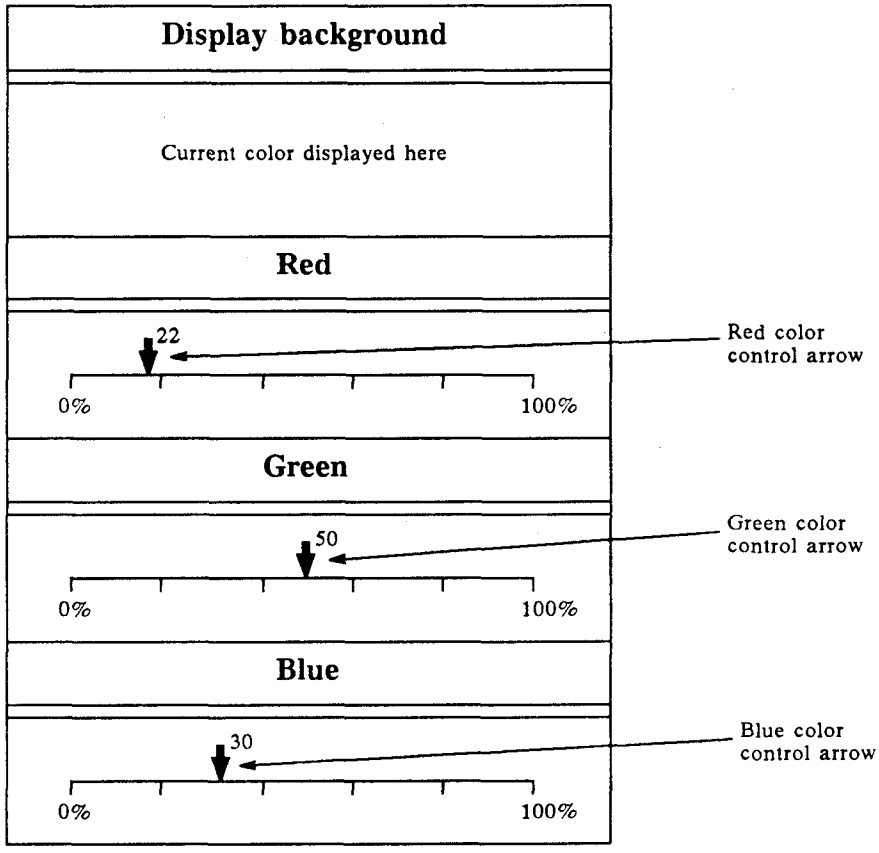

Figure 6. Color Control Panel

beep is by selecting the "keyboard setup" item from the "workstation setup" menu shown in Figure 4. This displays the menu shown in Figure 7 containing the item "bell volume". If you select the bell volume item, a volume control like the one in Figure 8 is displayed.

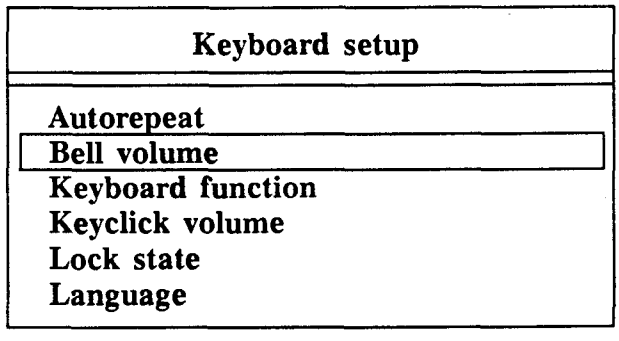

Figure 7. Color Display Setup Menu

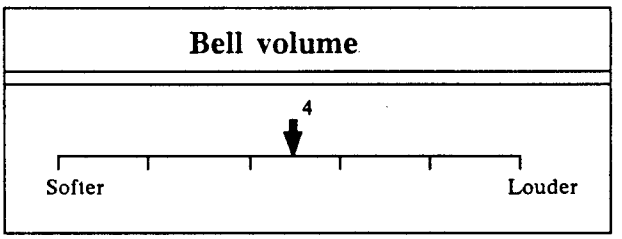

Figure 8. Bell Volume Control Panel

The volume control works similar to the color controls. To adjust the bell volume, you position the mouse on the control arrow, press the leftmost mouse button and hold it down, move the mouse pointer (and the control arrow) horizontally to change the volume, and release the mouse button. As you move the control arrow the VAXstation will beep at the current volume setting, so you can hear how loud it is.

The only other parameter in the "keyboard setup" menu that you may want to change is the "keyclick volume". The VAXstation can make a faint keyclick or chirping sound each time you press a key. Some people like this feature, and others do not.

The keyclick volume is adjusted the same way as the bell volume. First you select the "keyclick volume" menu item from the "keyboard setup" menu. This displays the keyclick volume control, which you adjust with the mouse. As you move the control arrow, the VAXstation will make a keyclick sound at the corresponding volume so you can adjust it to whatever you like.

Printer setup

Another feature of the workstation software is the capability to print all or part of the screen. Colors are converted to black and white (or to shades of gray) and the screen image is sent to a printer.

If you select the "printer setup" item from the workstation setup menu shown in Figure 4, the menu shown in Figure 9 is displayed. The two items of interest in this menu are the "color conversion method" and the "ribbon or toner saver".

If you select the "color conversion method" menu item, the options are displayed in a box as shown on the left side of Figure 10. The option currently selected has a check mark in front of it. Only the first two options apply to VAXstations in Department 9140 because our color printer is not compatible with the screen dump format. The "black and white" option converts all colors to black or white, and the "gray

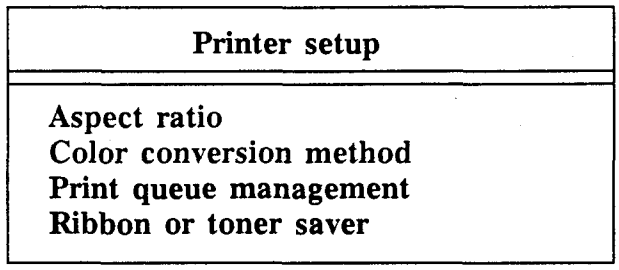

Figure 9. Printer Setup Menu

shades" option converts colors to shades of grey. Normally the "black and white" option works best for screen printouts.

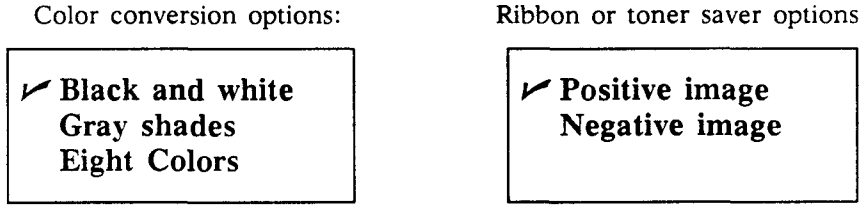

Figure 10. Printer Setup Options

If you select the "ribbon or toner saver" menu item, two options are displayed as shown on the right side of Figure 10. The option currently selected has a check mark beside it. The only way you know which option to pick is to try a screen printout as shown on page 32. If the background of the printout is black, then you need to change the "ribbon or toner saver" selection to the other option. This reverses the color conversion so everything that is black becomes white and vice-versa.

Default window size

When you create a new terminal window to login, its size is determined by the workstation setup parameters. You can change the default window size by selecting the "VT200 Series terminal attributes" item from the workstation setup menu shown in Figure 4. This displays the menu shown in Figure 11 containing two items you can use to change the default window size: "page length" and "page width".

If you select the "page length" menu item, a page length control panel is displayed as shown in Figure 12. This works the same as other controls. To change the page length, you position the mouse pointer on the control arrow, press and hold the left

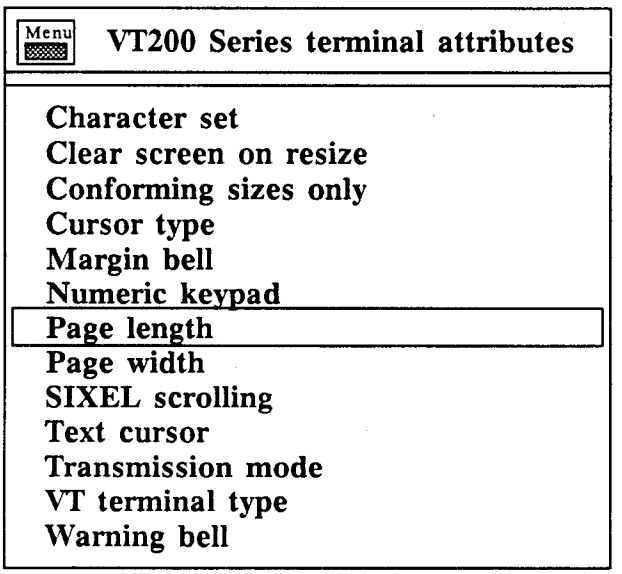

Figure 11. VT200 Series Terminal Attributes Menu

button, move the mouse to drag the control arrow left or right changing the page length, and then release the mouse button.

As you slide the control arrow left or right the number displayed to its right changes. This number represents the number of lines of text that can be displayed in the window. A typical window is sized for 24 to 60 lines of text.

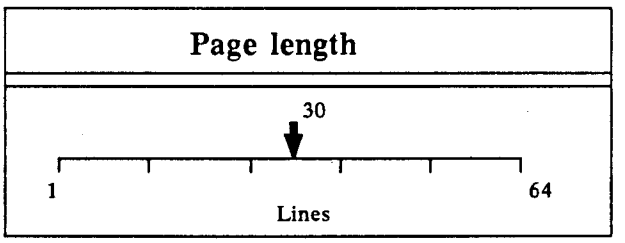

Figure 12. Page Length Control Panel

If you select the "page width" menu item, a control panel is displayed as shown in Figure 13. The page width is given by the number of characters or columns that can be displayed in one line of a window. Normally this is between 80 and 132 characters, with 80 characters or columns the most common. The page width control panel works the same way as the page length panel.

Saving the workstation setup

After you have the workstation set up the way to want it, you can save the setup parameters by selecting the "save current settings" menu item in the workstation

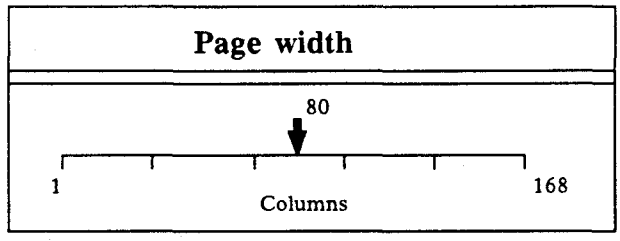

Figure 13. Page Width Control Panel

setup menu as shown in Figure 14. If you change the workstation setup and decide

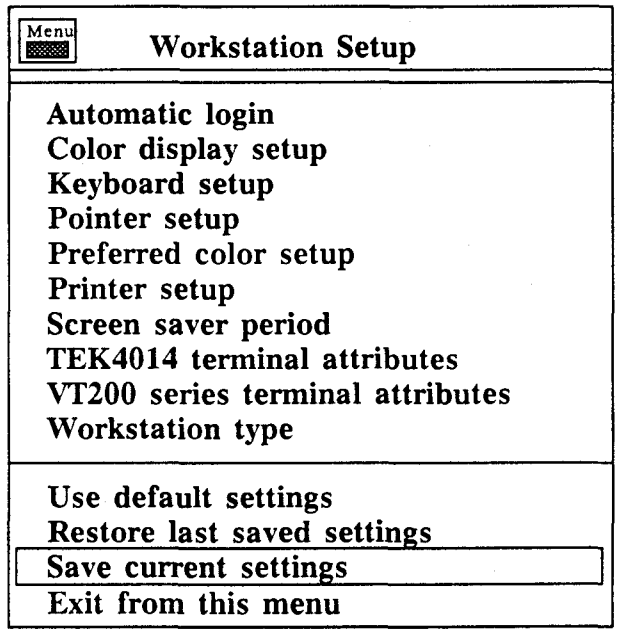

Figure 14. Workstation Setup Menu

you do not like the new parameters, you can restore the parameters back to their default values by selecting the "use default settings" menu item, or you can restore the parameters to the last saved values by selecting the "restore last saved settings". These menu items can be selected even though other setup menues may be displayed.

Exiting the workstation setup

When you have finished making changes to workstation setup parameters, you need to select the last menu item, "exit from this menu". You can select this menu item at any time, even if other workstation setup menues are displayed. This item removes all setup menues from the screen. When you press the left mouse button

again, the "workstation options" menu is displayed, which lets you create a terminal window and login.

3.2. Windows

On VAXstations windows are used to display nearly everything. When you login to a workstation, you create a window that acts like a terminal. When you run software requiring graphics, it usually creates a window for displaying the graphics.

ANVIL-5000 is the only software available on the department VAXstations that has the ability to run without using a window, and it can be run inside a window or you can let it use the full screen without a window. Most people let it run inside a window so they can have access to other terminal windows and so they can print screen dumps.

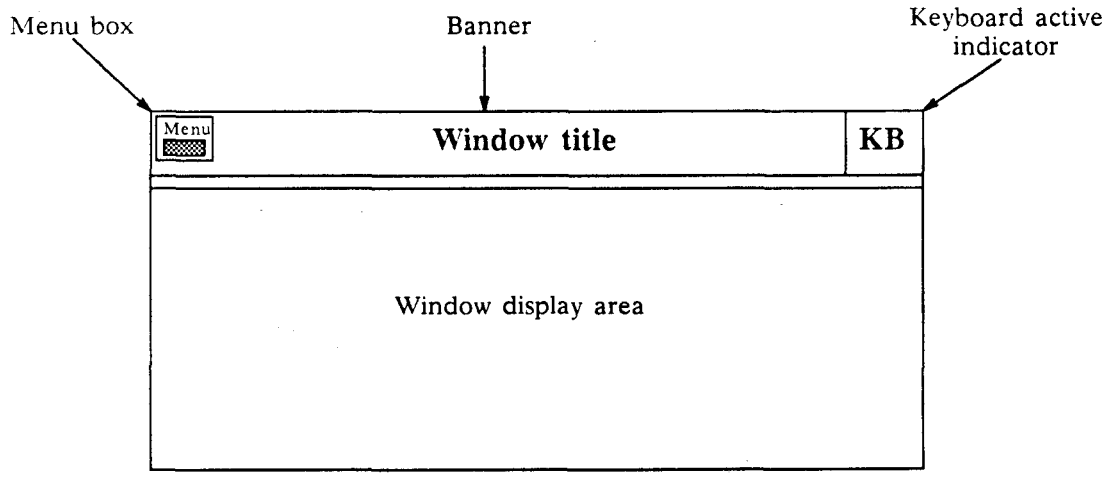

Figure 15. Window Terminology

Terminology

Windows all have a border and a banner as shown in Figure 15. They may also have a small box on the left side of the banner labeled "menu" and a small box on the right side of the banner labeled "KB". If the window has a "menu" box, then you can change its size, and if it has a "KB" box, then you can associate the keyboard with the window for entering text. Windows without the "menu" box are of fixed size (the window with the date and clock in the upper-right corner of the screen is an example), and windows without the "KB" box cannot accept input from the keyboard.

You can have more than one window on the screen at a time. For example, you can create more than one terminal window and login to each one. This way you can do several tasks at the same time. Some application programs also create more than one window.

The mouse can be used in any window. It becomes associated with a window when the pointer or cursor on the screen is within a window. Application programs that use the mouse often change the shape of the pointer to indicate when it can be used for input.

The keyboard can only be associated with one window at a time. The box labeled "KB" on the right side of the banner tells you which window the keyboard is associated with. If the "KB" box is the same color as the window background, then the keyboard can be used for input. If it is the window foreground color (the same color as the banner), then the keyboard is not associated with the window.

Cycling between windows

When you have more than one window on the screen, they may overlap so that one window hides all or part of the contents of another window. If you want to see a window that is hidden, you can use one of several methods. If part of the window is visible, you can position the mouse pointer in the window and press the left button. This brings the window to the "front" so you can see all of it. In the process it may hide all or part of windows that were previously visible.

Another way to make all of a window visible is to press the "Cycle" key (function key F5). This key cycles through the windows on the screen bringing each one to the front; however, it only cycles through windows that can accept input from the keyboard.

Finally, if the window has a "menu" box in its banner, you can click the mouse in the menu box to get a "window options" menu displayed as shown in Figure 16. As you move the mouse pointer in the menu, choices are highlighted. The first two choices let you control which windows are in front and which ones are in back. If you select the "push behind" menu item, the window is placed behind all other windows, and if you select the "pop in front" item, the window is placed in front of all other windows.

The window that is in front of all other windows and can accept input from the keyboard is often called the "active" window. To properly run some software packages you must know which window is active, and you must know how to make a window the active one.

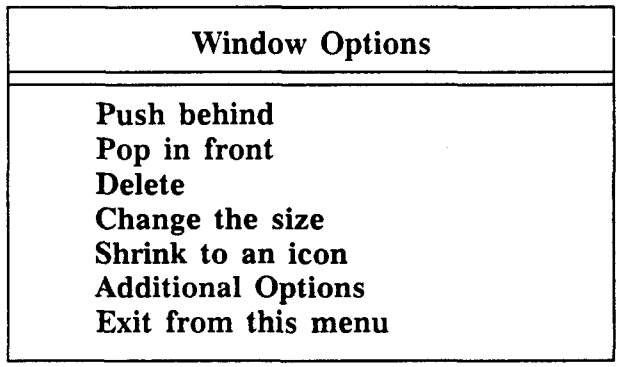

Figure 16. Window Options Menu

Moving windows

You can move windows on the screen so you can see more than one of them at a time. This is accomplished by putting the mouse pointer in the banner area of a window (usually on the window title), pressing and holding the left mouse button, and moving the mouse. As you hold the left button and move the mouse, an outline of the window, representing the new location of the window, follows the motion of the mouse. When you release the mouse button, the window is moved to the new location.

You can move a window so that part of it is off the screen, but you cannot move the entire window off the screen. A corner or side of the window must be left visible on the screen.

Changing the window size

You can change the size of most windows in the workstation software; however, those without a "menu" box in the banner cannot be changed. They are of fixed size. Windows with a menu box can be resized by clicking the mouse button on the menu box to get the "window options" menu, and then selecting the "change the size" menu item.

This causes the workstation software to display eight small square symbols at the corners and along the sides of the window. The symbol are blinking so you can easily see them. To change the size of the window, you need to position the mouse pointer on one of the small squares, press and hold the left button, and move the mouse. As you move the mouse, an outline of the window follows the mouse location indicating the new size of the window. When you release the mouse button, the window is redrawn to the new size.

Normally you use one of the corner symbols to change the size of a window, because they can change both the width and length of the window. However, if you only want to change the width, you can use the symbol on the left or right side of the window. And if you only want to change the length, you can use the symbol on the top or bottom of the window.

If the window is a VT200 series terminal window that you have used to login to the VAXstation, you can use another method to change the window size. The window size can be designated by the number of lines of text that it can display (the length) and the number of characters per line (the width). The workstation software adjusts the size of the window so it can display the requested lines of text.

To change the length of a window, you use the command

```
$ SET TERM /PAGE=n
```

where *n* is the number of lines of text that you want to display. If it cannot display all of the lines that you requested, it will make the window as long as possible.

To change the width of a window, you use the command

```
$ SET TERM /WIDTH=m
```

where *m* is the number of characters or columns per line. Again if it cannot display all of the characters that you requested, it will make the window as wide as possible.

You can change both the length and width at the same time by specifying both the /PAGE and /WIDTH options. For example, the command

```
$ SET TERM /PAGE=24 /WIDTH=80
```

adjusts the size of the window to display 24 lines with 80 characters per line. This is the same as a standard VT200 series terminal display.

Window icons

If you want to keep a window available to you, but you do not want it cluttering your screen, you can have the workstation software represent the window with an "icon" or small symbol as shown in Figure 17. When a window is represented by an icon, it is inactive. In other words, you cannot enter data with the mouse or keyboard.

The icon still represents a process running on your workstation, that is, you still remain logged into the system, but you cannot interact with the process or window.

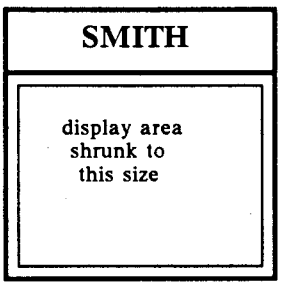

Figure 17. An Icon Representing a Window

This feature is useful if you want to stop working on one task for a while or if you need to let the VAXstation work on a task for a while with no interaction. You can shrink the window to an icon, and then proceed to work in another window for a while.

To change a window into an icon, you use the mouse and click on the menu box in the window banner. If the window does not have a menu box, you cannot convert it to an icon. The "window options" menu is displayed when you click on the menu box. If you pick the menu item "shrink to an icon", the window is converted to an icon symbol.

If you are working inside a terminal window and you have been entering DCL commands, you can enter the command

```
$ ICON
```

to convert the window to an icon. This is sometimes easier than using the mouse and menu box, but you can only use it in a terminal window when you have the dollar sign prompt.

To change the icon back to a window, you just put the mouse pointer on the icon and press the left mouse button, in other words, you click on the icon. The icon is immediately converted back to a window.

Window title

The window title displayed in the banner is set up by the application program used to create the window. If the window represents a terminal (either a VT200 or Tektronix 4014), you can change the title with the command

```
$ BANNER  title
```

where *title* is the new window title. The window title can be used to help you remember what you are working on.

The default window title for terminal windows is the network name (or "node") and your user name. If you login to another workstation over the network, the window title is automatically changed to the network name of the workstation.

Special keys

The first two function keys, F1 and F2, are used by the workstation software for special functions. The F1 key is called the "hold screen" key. It freezes the display so nothing further is displayed.

It is useful when you are listing a large amount of text on the screen and it is scrolling too fast to see. You can press the "hold screen" key to stop the text from scrolling, and then press it again to continue. If your machine quits responding, you should check to be sure that you have not pressed the "hold screen" key accidentally.

The F2 key is called the "operator window" key, and in general it should never be used. If you press the F2 key, the top part of the display is blanked and the colors are converted to black and white. If you press it again, the screen is restored.

Occasionally, the VAX/VMS operating system sends a message to the screen, and it is displayed in the "operator window". It will cause the screen to appear just like it does when you press the F2 key. If you press the F2 key, you can restore the screen to its original appearance.

Clearing a terminal window

If your window represents a VT200 series terminal, you can clear the display area by entering the command

```
$ CLS
```

which stands for "clear screen". This works only when you have the dollar sign prompt in a VT200 terminal window.

Another way to clear the screen is to clear or reset the terminal. The reset option clears the screen and resets the terminal's characteristics, and it makes sure the operating system knows the window size.

You clear or reset the terminal by clicking on the menu box to display the "window options" menu. Then you select the "additional options" menu item, which displays the menu shown in Figure 18. The "clear display" menu item clears the terminal display area, and the "reset display" resets the terminal.

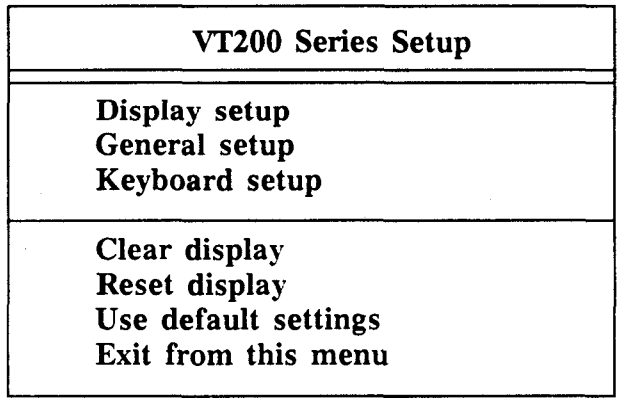

Figure 18. VT200 Series Setup Menu

Usually you should use the "clear display" to clear the screen. However, if the terminal stops acting correctly after using a program (usually this happens if you interupt a program with a control-y command), then you probably need to reset the terminal.

Changing fonts

Several different sizes of characters or fonts can be used in a terminal window. The default font uses characters that are 14 points high and 9 points wide, where a point is 1/72 inch. The font can be changed with the command

```
$ FONTS
```

This command displays a list of the terminal fonts available on your workstation, and it lets you enter a number corresponding to the one you want. For example,

```
$ FONTS

    Change Terminal Fonts

 Select a font from the following list:

    1) DTABERO  12-Point,   7-Pitch
    2) DTABERO  14-Point,   9-Pitch
    3) DTABERO  12-Point,  13-Pitch
```

```
4) DTABERO  24-Point,  13-Pitch
5) DTABERO  14-Point,  18-Pitch
6) DTABERO  28-Point,  18-Pitch
7) DVWSVTO   2-Point,   1-Pitch
8) Exit with no change

Enter font [1-8]: 1
```

You will have to experiment with the fonts to decide which one you like to use. As the characters get larger, less of them can be displayed in a window. So there is a tradeoff between larger characters, which are easy to read, and small characters, which use less room on the screen. The window size is adjusted to accomodate the font you select.

Printing screen dumps

The workstation software can be used to print part of the screen. If the area you select to be printed is larger than will fit on one piece of paper, it will put it on two pieces of paper. It will not reduce the image to fit on a single sheet of paper. This is a problem that we hope will be corrected if future versions of the workstation software.

To print part of the screen, you need to position the mouse pointer in an area of the display that is not used by a window and press the left button. This displays the menu shown in Figure 19. Move the pointer down until the "print (portion of)

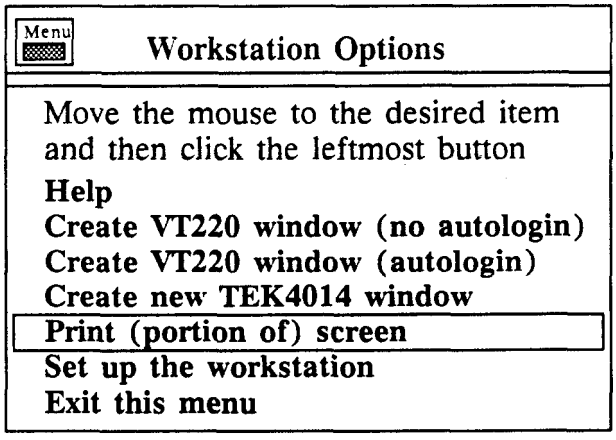

Figure 19. Workstation Options Menu

screen" menu item is highlighted and click the mouse. The mouse pointer changes shape to indicate that the "print screen" item was selected.

Now you need to move the pointer to one corner of the area that you want printed, press and hold down the left mouse button, and move the mouse pointer to the other

corner of the area. As you move the mouse, a rectangular outline of the area to be printed is displayed. When you get the pointer at the other corner, you can release the mouse button.

The pointer changes to an hourglass shape, which means the workstation software is converting the screen image to a print file. You will have to wait until this process is finished (usually 15 to 45 seconds). When the hourglass changes back to the mouse pointer, the image is sent to a printer. In Department 9140 it is sent to the nearest Talaris 1590 printer on the network.

Clock

A window is always displayed on the screen, usually in the upper-right corner, with the current date and with a clock showing the time. You can move this window to a different location, but you cannot change its size or delete it. Sometimes, for example after running an application like ANVIL-5000, the clock window display disappears. You can restore it by pointing to it with the mouse and pressing the left mouse button.

Deleting windows

Windows created by application programs, such as ANVIL-5000, Interleaf and EGS, are deleted when you exit or quit the program. All programs have some way to let you stop them or exit them, but they all use different methods. You have to consult the reference manual for the program to find out how to exit it.

Windows created with the workstation software to represent terminals are deleted when you logoff the VAXstation. If you have created several windows and logged into them, then you need to logoff of each window. The logoff command is

```
$ LO
```

You can also delete a window by selecting the "delete" menu item in the "window options" menu (the window options menu is displayed when you click in the window's menu box). If the window is a terminal, you are automatically logged off the machine. And if the window is from an application program, the workstation software tries to interupt or stop the program and delete its windows.

Other window options

Many other window options are available in the workstation software that will not be given in this manual. Most of these options are not commonly used so you do not need to be concerned with them. They are discussed in detail in Reference 2.

4. Files

A "file" is an object on a disk or tape containing information. For example, files can contain text, such as a memo or letter; they can contain graphics, such as a drawing; and they can contain programs. All information permanently stored on a VAXstation is stored in files. The number of files that you have and the amount of data in each file is limited only by the total amount of disk storage available on your workstation.

Files can be divided into two types: text and binary. Text files contain character information that you can list on the screen. You can also use standard computer programs called "text editors" to modify this type of file. Binary files contain information that does not directly represent characters or text. Usually these files contain numbers stored in binary. These files cannot be listed on the screen, and special software must be available to modify them.

Files are used by computer programs to store information. Some computer programs require input data from files, and most computer programs output results to a file. Files are also used to communicate between different computer programs; for example, one program creates a file that is input to another program.

Each file on a VAXstation has a name identifying it, called a "filename". The name refers to the entire file. To access only part of the file, you must use a computer program such as a text editor.

Groups of files are stored in "directories". A directory is a file containing information about other files (the files associated or stored in the directory). One way to organize your files is to put all files used on a project in the same directory.

Directories and files are stored on disks or on tape. Disks are permanent, high-speed, magnetic storage media used on nearly every computer system from PC's to Crays. The VAXstations in Department 9140 have at least one disk, and some of the systems have three disks. Most files on the VAXstations are stored on disks; tapes are used only for backup and for transferring files between machines.

The concepts of disks, directories, and files are illustrated in Figure 20. You must remember that the directories are also files containing a list of the files associated with them; for example, *directory–1* in Figure 20 has information in it about *file–1*, *file–2*, and *file–3*.

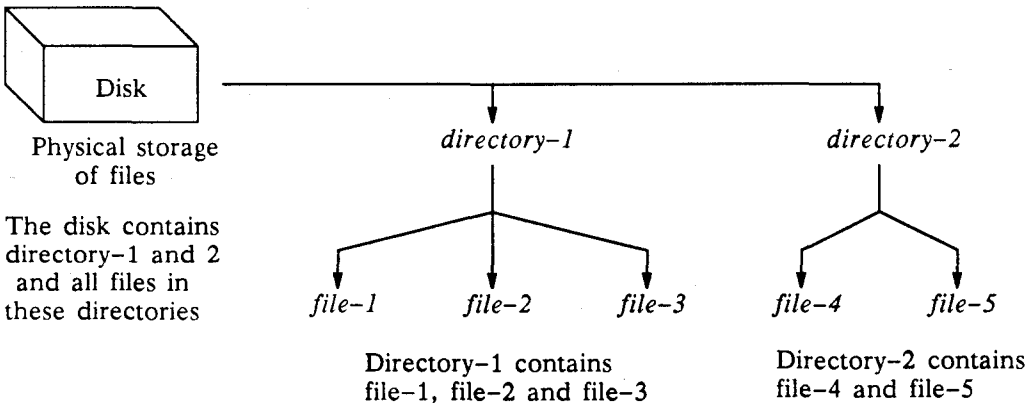

Figure 20. File Storage

The remainder of this section is divided into three subsections: (1) Section 4.1 discusses filenames, (2) Section 4.2 discusses directories, and (3) Section 4.3 discusses DCL commands that manipulate files.

4.1. Filenames

Each file has a name identifying it. The name must provide enough information so the operating system can locate the file and retreive its information. A complete file specification is shown in Figure 21. When you enter DCL commands and when you

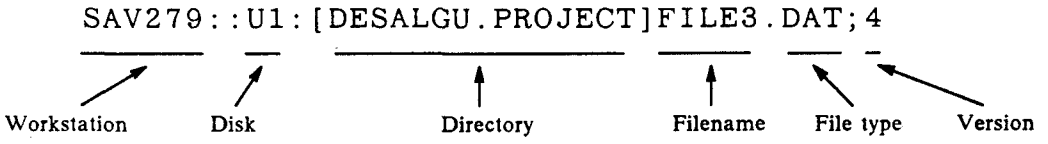

Figure 21. Full File Specification

run application software, you will often be asked to provide one or more filenames. You must type in a name in the form shown in Figure 21, although you generally do not need to enter all parts of the file specification.

The first part of the name specifies the workstation containing the file. The network name or node name is used to identify the workstation. This is followed by two colons and name of the disk containing the file. The directory name is given next, followed by a filename and file type. A file version number is given last.

The punctuation used to separate the items in the full file specification is important. Directory names are always enclosed with brackets, filenames and file types are always separated with a period or dot, and version numbers always follow a semicolon.

The full file specification is long, and it requires a lot of typing. Fortunately you do not always have to provide the full file specification because you can take advantage of default values.

Defaults

The workstation name always defaults to the workstation that you are logged into. Unless you are copying files from another workstation over the network, you do not need to provide the workstation name as part of the file specification.

When you login to a workstation, you are given a default disk and directory. Usually all of your files can be stored on one disk, and this disk is designated to be your default disk. So you do not have to provide the disk name unless you are copying files from another workstation or another user on a different disk.

If all of the files that you are working with are in the same directory, you can make this directory your default directory. Then you do not have to provide the directory name either.

The one part of the full file specification that is always required is the filename. It is the minimum amount of information required by the operating system to locate a file. The filename can have up to 39 characters chosen from the letters A through Z, the numbers 0 through 9, the dollar sign, and the underscore character.

The file type is optional, and it can also have up to 39 characters. The file type is separated from the filename by a period. Usually the file type is used to indicate the type of information stored in the file; for example, the following file types are commonly used:

COM	- DCL command procedure files
DAT	- Data files for computer programs
DIR	- Directory file
FOR	- FORTRAN source files
LIS	- Listing or printout files
PRT	- ANVIL-5000 part files
PLT	- ANVIL-5000 plot files

Some programs such as ANVIL-5000 have default file types built-in, so you do not need to provide the file type when you enter a filename unless it is different from the default.

The last part of the full file specification is the version number. It is separated from the file name and type by a semicolon. When you originally create the file the version number is one. Each time you revise the file and create a new version, the version number is increased by one. Most of the time you do not need to specify a version number. The VAX operating system automatically selects the highest version number for you (this should be the most recent version).

Examples

Some examples of the use of filenames is shown below:

```
$ TYPE  JERRY.DAT

$ PRINTV  [DESALGU]MEMO.TXT

$ COPY  SAV29::UD2:[DESALGU]TEST.FOR  X.FOR
```

The first example displays the file JERRY.DAT on the screen in the terminal window. This is the most common way of specifying a file, where only the filename and type have been given. The default workstation, disk, directory, and version number are used.

The next example prints a file called MEMO.TXT in the directory [DESALGU]. In this case the file that needed to be printed was not in the default directory, so a directory name was given.

The last example copies a file from another machine. Two filenames have been given. The full file specification was given for the first file because it is referencing a file on another workstation or VAX. As a general rule, anytime you access a file on a different machine, you must provide the full file specification. The second file uses the default values for the workstation, disk, directory and version.

The version number was not used in any of the examples. It is seldom required unless you want to retrieve an older version of a file.

Wildcards

Many DCL commands can operate on several files at a time by using a "wildcard" as part of the filename; for example, you can copy more than one file with a single

command. A wildcard is a special symbol, an asterisk, that is best described with examples.

If you wanted to print all versions of the file TEST.DAT, you could use the wildcard character as follows:

```
$ PRINT  TEST.DAT;*
```

The asterisk tells the operating system to print all versions of the file. If you leave off the asterisk and supply a version number, only one file is printed. Similarly, if you do not specify a version number, it defaults to the highest version and only one file is printed.

You can print all files with the file type .DAT with the following command:

```
$ PRINT  *.DAT
```

If you only wanted to print the files that started with the letters TX, you can use the command

```
$ PRINT  TX*.DAT
```

The asterisk only works for filenames, file types, and version numbers. A different wildcard can be used for directory names, which will be shown in the next section. Wildcards cannot be used for disk or workstation names.

4.2. Disks and Directories

A disk can contain many files belonging to many different users, so the files for each user are kept in separate directories as shown in Figure 22. Each disk has a device directory containing directories for each user called "root directories" or "home directories". When a you login to a VAXstation, your default directory is automatically set to your home directory on your assigned disk.

Additional directories, called "subdirectories", can be created beneath the root directory in a hierarchical or tree structure as shown in Figure 23. Subdirectories at a lower level in the tree structure are related to or associated with the next higher directory. Files can be stored in any subdirectory just like in the root directory.

Each subdirectory has a name consisting of the directory name from the next higher level, a period, and a subdirectory name as shown in Figure 23. The subdirectory

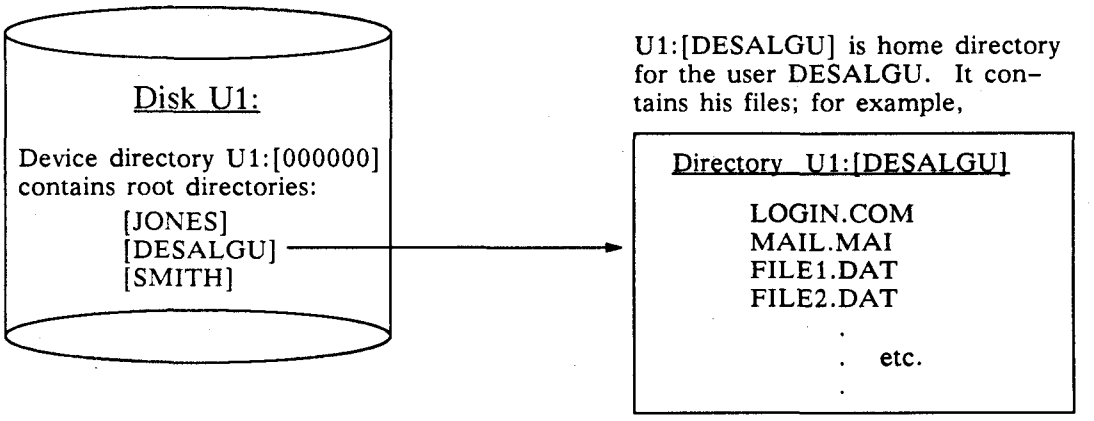

Figure 22. Disks and Home Directories

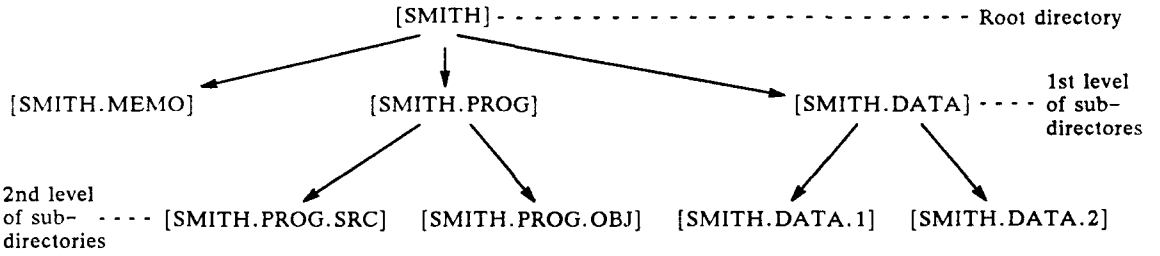

Figure 23. Subdirectory Tree Structure

name can have up to 39 characters, and you can use the letters A through Z, the numbers 0 through 9, the underscore character, and the dollar sign. If you use descriptive names, you can use subdirectories to organize your files so you can remember where they are located.

Creating subdirectories

When you login to a workstation for the first time, you will only have your root directory. This directory is created by the system manager when he sets up your account on the workstation. You create your own subdirectories with DCL commands. You can create as many subdirectories as you need to organize your files.

The command to create subdirectories is part of DCL, so you can only execute it after you login to a terminal window. If you are in your default root directory, for example [SMITH] as shown in Figure 23, you can create a subdirectory called [SMITH.DATA] with the command

```
$ CREATE/DIR  [.DATA]
```

or with the command

```
$ CREATE/DIR  [SMITH.DATA]
```

Both commands create the same subdirectory; however, they have slightly different meanings to the operating system. The first command says to "create a new subdirectory beneath the current default directory called [.DATA]". The default directory does not have to be the root directory. If, for example, your default directory is [SMITH.PROG], you can create the directory [SMITH.PROG.OBJ] with the command

```
$ CREATE/DIR  [.OBJ]
```

This command creates a new level of subdirectories beneath your current default directory.

The second form of the "create directory" command specifies the complete directory name that you want created, in this case it is [SMITH.DATA]. This command works regardless of your current default directory. It requires more typing, but it is safer to use than the previous form shown.

Setting the default directory

As stated previously, when you login to a VAXstation, your current default directory is your root or home directory. If you have defined subdirectories, many commands are available to let you change your default directory to any of the subdirectories. The commands shown here are special ones available for VAX systems at Sandia; they are not part of the standard VAX DCL commands.

You can make any directory your default directory with the "set default" command, abbreviated by "SD". For example, to make the directory [JONES.TEST] your default directory, you can use the command

```
$ SD  [JONES.TEST]
```

This command is useful to immediately make a directory your default, but it requires more typing than is usually necessary.

If the directory that you want is at a lower level in the directory tree structure, you can use the DOWN command. For example, if your current default directory is [SMITH.PROG] and you want to make [SMITH.PROG.SRC] your default directory, you can use the command

```
$ DOWN  SRC
```

You can use this same command to move more than one level below; for example, if your default directory is [SMITH] and you want the default directory [SMITH.PROG.SRC], you can use the command

```
$ DOWN  PROG.SRC
```

To move up the tree to the next higher level, you use the UP command. For example, if your current default directory is [SMITH.PROG.SRC] and you enter the command

```
$ UP
```

your new default directory is [SMITH.PROG]. You can continue entering UP commands until you reach your home directory.

A similar command is the RETURN command, which returns you to the directory that was your previous default directory. For example, if your current default directory is [SMITH.DATA] and you use the command

```
$ DOWN  1
```

to make the directory [SMITH.DATA.1] your default directory. You can return to the [SMITH.DATA] directory with the command

```
$ RETURN
```

At any time you can return to your home or root directory with the command

```
$ HOME
```

One last command is available, called OVER, to set your default directory. This command lets you change your default directory to another directory on the same level and in the same tree structure. In the example tree structure in Figure 23, if your default directory is [SMITH.PROG.SRC], you can use the command

```
$ OVER  OBJ
```

to make the directory [SMITH.PROG.OBJ] your new default. This is legal because both directories are on the same level and they are both related to the next higher directory [SMITH.PROG]. You could not make [SMITH.DATA.2] your default with the command

```
$ OVER  2
```

because this directory is related to [SMITH.DATA] not [SMITH.PROG]. You would first have to use an UP command to move up to [SMITH.PROG], then an OVER command to [SMITH.DATA], and finally a DOWN command to [SMITH.DATA.2].

Listing files in a directory

Two short commands are available for listing the files in a directory: DIR and VDIR. With no options specified, the DIR command lists only the names of the files in a directory; for example,

```
$ DIR

Directory  U1:[DESALGU.CAL]

CAL.ATR;7           CAL.COM;3          CALC.COM;1          CALC.EXE;53
CALP.COM;2          CALP.EXE;8         COMMON.DIR;1        EDTFILE.DAT;1
OBJECT.DIR;1        SOURCE.DIR;1

Total of 10 files
$
```

Three of the files in this listing are of type .DIR. These files are directory files indicating that you have defined subdirectories beneath the current default directory. In this case there are three subdirectories: [DESALGU.CAL.SOURCE], [DESALGU.CAL.OBJECT], and [DESALGU.CAL.COMMON].

The VDIR command lists the files, but it also lists the size of the file, the date it was last modified, the file owner, and the file protection. An example is shown below where the same directory has been listed with the VDIR command.

```
$ VDIR

Directory  U1:[DESALGU.CAL]

CAL.ATR;7         1  7-FEB-1989 14:13  [DESALGU]  (REWD,REWD,RE,RE)
CAL.COM;3         1 13-DEC-1988 17:08  [DESALGU]  (REWD,REWD,RE,RE)
CALC.COM;1        1 12-DEC-1988 15:29  [DESALGU]  (REWD,REWD,RE,RE)
CALC.EXE;53     453  7-FEB-1989 14:22  [DESALGU]  (REWD,REWD,RE,RE)
CALP.COM;2        1 12-DEC-1988 15:30  [DESALGU]  (REWD,REWD,RE,RE)
CALP.EXE;8      311  7-FEB-1989 14:23  [DESALGU]  (REWD,REWD,RE,RE)
COMMON.DIR;1      1 11-DEC-1988 12:22  [DESALGU]  (REW,REW,RE,RE)
EDTFILE.DAT;1     1  7-FEB-1989 12:54  [DESALGU]  (REWD,REWD,RE,RE)
OBJECT.DIR;1      1 11-DEC-1988 12:22  [DESALGU]  (REW,REW,RE,RE)
SOURCE.DIR;1      3 11-DEC-1988 12:22  [DESALGU]  (REW,REW,RE,RE)
```

```
Total of 10 files, 774 blocks
$
```

The first column contains the name of each file, the second column is the size of the file in blocks (a block is 512 bytes or characters), the next two columns give the time and date that the file was created or modified, the next column gives the name of the file owner, and the last column gives the file protection.

If you are listing files in your own directories, the file owner should be yourself. If it is not, it indicates a problem, and you should get your system manager to look into it.

The file protection is used to grant or deny other users access to your files. There are four classes of protection: system, owner, group, and world. The system protection has little effect, since the system manager can override it. The owner protection should allow you full privilege to read, execute, write, and delete the file. The group and world protections allow other users access to the file. Usually they have no access, or they have read and execute access.

The protections given in the VDIR listing are abbreviated as follows: R for read privilege, E for execute privilege, W for write privilege, and D for delete privilege. The first set of letters gives the system protection, the next set the owner protection, the next set the group protection, and finally the world protection. File protections can be changed with commands discussed in Section 4.3.

The DIR and VDIR commands can be used to list part of the files in a directory by including a file specification as part of the command. Usually this involves the wildcard character (an asterisk). For example, the command

```
$ DIR  *.DIR
```

lists all files that have the file type .DIR. This has the effect of listing all subdirectories below the current default directory.

You can also use the DIR and VDIR commands to list information in more than one directory. You can list all files in the current directory and its subdirectories (those beneath it in the tree structure), by using the directory "wildcard" of three periods. For example, the command

```
$ DIR  [JONES...]
```

lists all files in the directory [JONES] and in all of its subdirectories. The triple dots in a directory name can be used in many DCL commands to indicate that you want all subdirectories included in the file specification.

Deleting directories

Directories can only be deleted if you have first deleted all files within them. So first you need to set the directory that you want to delete to be your default directory. Then you need to delete all files in that directory. The last steps are to move up the directory tree structure one level, change the file protection of the directory file, and then delete the file.

In the following example, the directory [SMITH.MEMO] is deleted:

```
$ SD  [SMITH.MEMO]

$ DELETE  *.*;*

$ UP

$ PRIVATE  MEMO.DIR;*

$ DELETE  MEMO.DIR;*
```

The SD command sets the default directory, and the DELETE command deletes all files in that directory. The UP command sets the next higher directory to be the default, and the PRIVATE command sets the protection so you can delete the file. The last command deletes the directory file, and thus, deletes the directory.

4.3. File Commands

Most of the commonly used DCL commands involve files. Commands are available for listing files on the screen, editing files, printing files, copying files, and so on. This section provides you with a working knowledge of these basic commands. For more information, you need to refer to Reference 1.

Displaying files

Binary files cannot be displayed on the screen, but text files can be displayed in the terminal window with the TYPE command. Since the VAXstations display text very rapidly, you probably want to use an option that displays a window of text and then waits for you to press the "return" key to continue. Otherwise, the text scrolls too quickly to read.

The following command displays a text file called MEMO.TXT:

```
$ TYPE/PAGE  MEMO.TXT
```

The /PAGE following the TYPE command is the option that stops listing the file when the window is full.

Sometimes the first character or column of a file is not displayed with the TYPE command. This means that the VAXstation thinks the file is a FORTRAN printout file with carriage control characters in the first column. You can change the file so the first character is displayed by entering the command

```
$ SETATR/CARRIAGE  MEMO.TXT
```

The next time that you display the file MEMO.TXT with the TYPE command, the first column will be displayed.

Similarly, if you have a FORTRAN printout file and you do not want the first column displayed, you can use the command

```
$ SETATR/FORTRAN  PRINT.OUT
```

which tells the operating system that the file PRINT.OUT has FORTRAN-style carriage control.

If you accidentally list a binary file, a lot of meaningless characters will be displayed and the terminal window may get messed up. You will probably need to reset the terminal window as shown on page 31.

Creating and editing files

Binary files are generally created and modified by application programs such as ANVIL-5000 and Interleaf; however, text files can be created and modified with standard VAX programs called text editors. The VAXstations in Department 9140 have three different text editors: EDT, EVE, and SLEM.

The text editor executed with the EDIT command is the standard VAX EDT editor commonly used on terminals connected to a time-sharing system, and it is documented in Reference 1. This editor has been available on VAX systems for many years. The only problem with using it on VAXstations is that it assumes your window is sized for 24 lines with 80 characters per line. If your window is a different size, the editor may not work correctly or you may have to reset the terminal each time you use the editor. For these reasons, the EDT editor is not recommended.

The text editor executed with the EVE command is the new standard VAX editor, and it is documented in Reference 1. The Department 9140 VAXstations are set up to automatically run EVE with an initialization file. This file sets up EVE to recognize the EDT keypad commands, and it defines the following special commands:

Gold-E - Save the file and exit the editor
Gold-I - Include a file
Gold-L - Go to a line number
Gold-Q - Do not save the file and exit the editor
Gold-R - Display a column ruler at the top of the window
Gold-S - Text substitution
Gold-T - Transpose two characters
Gold-W - Save the file
Gold-↑ - Set the window width to 132 characters
Gold-↓ - Set the window width to 80 characters

This file can be modified by the system manager to define additional commands as needed.

The most popular editor on VAX's at Sandia is executed with the SLEM command. The SLEM editor, documented in Reference 3, is an enhanced version of the EDT editor. If you know how to use EDT, then you can use SLEM with little additional training. The SLEM editor is also similar to an older editor used at Sandia called SLAVE.

To use the SLEM editor, you use the command

```
$ SLEM file
```

where *file* is a file specification. If the file exists, SLEM lets you modify it. If it does not exist, SLEM lets you create a new file.

If you are creating a new file (you provided the name of a file that does not exist), SLEM displays some messages and then clears the window display except for a [EOB] at the top and a couple of message lines at the bottom. If you type something, it displays it in the window. You can use the cursor keys to move the cursor around the display, and you can use the backspace key to delete characters. You should refer to the manual, Reference 3, for more information on how to edit files.

When you are finished, you press and hold down the "PF1" key located in the numeric keypad and at the same time press the "E" key. This command saves the information that you entered in the file and exits the editor.

Printing files

On the Department 9140 VAXstations several commands have been set up to print files on the different printers. If your workstation does not have a printer connected, you can still send files over the network to the nearest printer. You use the same commands to print files over the network as you do when you have a printer connected directly to your machine.

To print a text file, for example the file LETTER.TXT, you can use the command

```
$ PRINT  LETTER.TXT
```

The text in the file is printed oriented in the "landscape" mode, where the lines of text are parallel with the 11 inch side of the paper. This orientation is commonly used for printout from FORTRAN programs that require 132 characters per line and 60 lines per page.

For a letter or memo, you usually want the text oriented in the "portrait" mode, where the lines are parallel with the 8 1/2 inch side of the paper. The same file can be printed in the portrait mode with

```
$ PRINTV  LETTER.TXT
```

If you are printing a graphics or plot file, you should use the PRINT command rather than the PRINTV command.

The PRINT and PRINTV commands send the file to the nearest laser printer. There are two different laser printers connected to the workstations. The older printers, called QMS-800's, print text at the rate of 8 pages per minute. The new printers, called Talaris 1590's, print text at the rate of 15 pages per minute. Graphics is printed three times faster on the Talaris printers than on the QMS printers, and only the Talaris printers can be used for screen dumps.

If you want to send a file to a specific type of printer, you can use one of the following commands:

QPRINT - Prints a file in the landscape mode on a QMS printer
QPRINTV - Prints a file in the portrait mode on a QMS printer
TPRINT - Prints a file in the landscape mode on a Talaris printer
TPRINTV - Prints a file in the portrait mode on a Talaris printer

Graphics files can also be sent to the Calcomp 5912 color printer with the CPRINT command; for example, the command

```
$ CPRINT  FOR077.DAT
```

sends the plot file FOR077.DAT to the Calcomp for printing. Before you send a file to the Calcomp, you need to check the printer and make sure it has the correct paper or transparency material loaded. It can print on A or B-size paper or transparencies, so you need to be sure the correct media is loaded before you try to print a file.

When you print files, you must be concerned with the carriage control. Files from FORTRAN programs use the first character in each line for carriage control (for example, to skip to a new page or to double space). Most other files do not use the first character for carriage control.

If you want a file to use the FORTRAN carriage control, then you can use the command

```
$ SETATR/FORTRAN  file
```

where *file* represents a filename. This forces the printer to use the first character in each line for carriage control.

If you do not want to use the FORTRAN carriage control, then you can use the command

```
$ SETATR/CARRIAGE  file
```

This forces the printer to print the first character in each line instead of using it for carriage control.

Print queues

When you enter a print command, the files are placed in a "queue" for printing. The queue is a holding area that avoids problems when files are sent to the printer faster than it can print. You can display a list of files in the print queues by entering the command

```
$ Q

Terminal queue SAV279_TAL, on TTA2:, mounted for T1590 (stock=DEFAULT)

  Jobname         Username     Entry   Blocks   Status
  -------         --------     -----   ------   ------
  FOR077          DESALGU        109       45   Printing

$
```

This command lists all print queues on the cluster and all batch queues on your workstation. The batch queues all have the word "batch" as part of their names. The print queues are called "print" queues, "terminal" queues and "logical" queues.

The example shown above lists a terminal queue called "SAV279_TAL", which is a Talaris 1590 printer. The "jobname" is the filename that you want printed, and the "blocks" is the size of the file. The "status" gives you the current status of the print job.

If you want to list all queues on all workstations, you can use the command

```
$ Q  ALL
```

If you send a file to a printer by mistake, you can delete the file from the print queue with the command

```
$ DEL/ENTRY=entry  queue-name
```

where *entry* is the number listed by the "Q" command in the "entry" column and *queue-name* is the name of the print queue. For example, the following command is used to delete the print job shown above in the print queue:

```
$ DEL/ENTRY=109  SAV279_TAL
```

If the file is currently printing and you delete it from the print queue, the printer will stop printing the file.

Copying files

You can make a copy of a file with the command

```
$ COPY  file-1  file-2
```

where *file-1* is the file that you want to copy from and *file-2* is the file that you want to copy to. For example, the command

```
$ COPY  TEST1.PRT  TEST2.PRT
```

copies the file TEST1.PRT to the file TEST2.PRT.

The copy command is most commonly used to transfer one or more files to another workstation, disk, or directory. A good method to use when copying files is to set your default directory to the location that you want to copy to, and then copy the

file. In other words, copy the files from the other machine, disk, or directory to your current default directory. This procedure minimizes problems with insufficient privileges.

For example, to copy the file SAV07::U1:[DESALGU]X.COM to your machine, you can use the command

```
$ COPY  SAV07::U1:[DESALGU]X.COM  *
```

The asterisk used for the second filename says to keep the filename the same, so after it copies the file, you will have a file called X.COM in your current default directory.

You can also use asterisks to copy more than one file at a file; for example, the command

```
$ COPY/LOG  SAV29::UD1:[DESALGU]*.FOR  *
```

copies all files of the type .FOR in the directory U1:[DESALGU] on the machine SAV29 to the current default directory. The /LOG option on the copy command displays a message after each file is copied. It is useful when you copy more than one file at a time, since it lets you know that the copy command is working correctly.

Renaming files

The names of files can be changed with the RENAME command. You can change the directory, the filename, the file type, and the version number; you cannot change the workstation or disk of a file (you must use the COPY command to change these).

To change the name of the file BRK.PRT to BRACKET.PRT, you can use the command

```
$ RENAME  BRK.PRT;*  BRACKET.PRT
```

The current filename is given first, followed by the new filename. This command changes the name of all versions of BRK.PRT, because the asterisk was used for the version number in the first file specification.

Deleting files

Files can be deleted with the DELETE command, which can be abbreviated DEL; for example, the command

```
$ DEL  MEMO.TXT;*
```

deletes all versions of the file MEMO.TXT. A version number must be specified when you use the DELETE command. In most cases you can use the asterisk as shown above to delete all versions of the file.

You should be careful deleting files, because you can accidentally delete files easily. If files are accidentally deleted, they can only be restored if they have been backed up to tape or another disk as shown in Section 5.

When you work with files on the VAX, you often create many versions of the same file. For example, each time you save a file with a text editor, it creates a new version of the file. In general you do not need to save more than the latest version of a file, that is, the file with the highest version number. In fact if you try to save all versions of all files, you will quickly use all of your disk storage.

Consequently, the VAX provides a command called PURGE, abbreviated PUR, that deletes all the old versions of all files in a directory. It can be used to "cleanup" your files and free disk space. It only saves the most recent version of each file (the file with the highest version number).

For example, the commands

```
$ SD [JONES.DATA]

$ PUR
```

deletes all old versions of files in the directory [JONES.DATA]

File protection

File protection is used to grant or deny other users access to your files. There are four classes of protection: system, owner, group, and world. The system protection has little effect, since the system manager can override it. Typical owner protection gives you full privileges to read, execute, write, and delete a file. The group and world protections allow other users access to a file. Usually they either have no access or they have read and execute access.

Each file has its own protection. If you want other users to have access to a file, they can be given privilege to read and execute the file. They should not be given privilege to write or delete the file.

To make all of this less confusing, two commands have been set up on Sandia VAX's to easily set a file's protection. The first command, called PRIVATE, re-

stricts access to a file to the owner and the system manager. The other command, called PUBLIC, gives any VAX user the capability to read or execute a file.

For example, to make the file FLANGE.PRT accessible by users on other workstations, you can enter the command

```
$ PUBLIC  FLANGE.PRT
```

Or if you do not want other users to have access to the file, you can enter

```
$ PRIVATE  FLANGE.PRT
```

Disk storage

The disks on each workstation hold between 150 and 400 million bytes of information (a byte holds one character). Disk storage is given in "blocks", where a block is 512 bytes. So a disk with 150 million bytes has about 300,000 blocks available, and a disk with 400 million bytes has about 800,000 blocks available.

You can use the command

```
$ SHOW  DEVICE  U2

  Device            Device      Error    Volume      Free  Trans Mnt
   Name             Status      Count     Label     Blocks Count Cnt

SAV280$DKA100:      Mounted         0     USER2     270637   140   1


$
```

to list the amount of free space available on each disk. You should try to keep at least 20,000 blocks free on your disks and preferably 50,000 block free.

In this example, the workstation has one disk containing all of the user's files. The disk has about 270,000 blocks of free space, so it is okay.

To remove files from a disk to create more free space, you can use the PURGE command to delete all old versions of files. Another way is to back up files to tape and delete them from the disk.

Other commands

Only a few of the VAX commands have been given. Many other commands are available on the VAXstations that work with files; for example, the FORTRAN

compiler converts source files into object files. Most of these commands are documented in Reference 1.

5. File Backup

As stated previously, disk drives are used to store files containing information. Disk drives are reliable storage devices, but they do fail, and often you have no warning that they are going to fail. Consequently, the files need to be copied periodically to a different storage device, usually a magnetic tape. The VAXstation workstations have a cartridge tape drive, called a TK-50, that can be used for backing up files.

The system manager in Department 9140 makes full backup tapes containing all files on the cluster about once every month. Incremental backup tapes containing only those files created or modified since the last backup are made every night. Despite this you may want to backup your files for additional protection. You can also use backup tapes to transfer files to other VAX systems not on the network.

The VAXstations have the standard VAX "backup" utility, as shown in Reference 4, installed as part of the VMS operating system. If you are familiar with mounting tapes and using the backup utility, then you can use it to copy files to tape or disk; however, it is easy to forget the syntax of the commands.

UBACK command

To make this task easier, a utility called "UBACK" has been developed by the author. This program can be used to copy files to a backup tape or disk and to restore files from a backup tape or disk. It prompts you for the information it needs to backup or restore files, so you do not have to remember complicated commands.

Some workstations do not have a TK-50 tape drive. If your workstation does not, then you need to login to one that does with the SETHOST command as shown in Section 6.2. Then you can use the tape drive on that system just as if it is your own.

The UBACK utility is executed by entering the command "UBACK" after the $ prompt; for example,

```
$ UBACK
```

This utility is part of the CAE software package installed on all Department 9140 VAXstations, and it can be installed on any VAX system.

Main menu

After you enter the UBACK command, the screen is cleared and the following menu is displayed:

```
   CAE Backup/Restore Program
       (Version 89.001)

(Use "?" for help and "Q" to quit
 after any prompt)

Select a backup/restore option:

 0 = Quit
 1 = Backup files (default)
 2 = Restore files
 3 = List files on backup device
>
```

After any prompt you can enter a "?" to get help. In this case the help message is

```
The "UBACK" command lets you backup files on your machine
to tape or disk.  Usually files are backed up to tape.  It
also lets you restore files from a backup tape created
previously, and it lets you list files on a backup tape.
Depending on the option that you select, you will be
prompted for additional information, such as the backup
device name, a "save-set" name, and the files that you
want to backup or restore.
```

Then the prompt with the backup/restore menu is repeated. This is typical of all help messages in UBACK.

Although this menu has a "0 = Quit" option, you can also quit or end the program by entering a "Q" after any prompt. If you decide part way through the procedure that you want to start over or quit, you can easily do so by entering a "Q" in response to the next prompt.

5.1. Backing up files

The first option in the main menu, "1", is used to back up files to disk or to tape. If you are backing up files to disk, you should check the amount of storage available on the disk to be sure enough is available. This can be done with the command

```
$ SHOW  DEVICE  D
```

This is a VAX command, so it needs to be done before you start the UBACK procedure. It will tell you the number of blocks of storage available on each disk in the cluster in a column labeled "free blocks".

You also need to use the VAX directory command to determine the number of blocks required for the files that you want to back up; for example,

```
$ DIR/SIZE/GRAND  [SMITH.TEST...]
```

lists the size of all files in all directories in and below [SMITH.TEST]. It also gives the total amount of storage used by these files. This total must be less than the number of free blocks on the disk that you are using for backup. In general you should not use more than 90% of the available space on a disk; otherwise, no room is available for scratch files used by the system and application programs.

If you are backing up files to tape, there is no quick method to determine the amount of free space on the tape. If you are backing up all of your files, you should probably use a new tape (or initialize an old one) so the whole tape is available. If you are only backing up new or modified files since the last backup, you can probably use one tape for 10 to 15 incremental backups depending on the number of files you work with.

When you select "1" from the main menu to backup files, the first prompt is for the backup device name, that is,

```
Enter device name that you are using to backup
your files (Default:  MUA0:)
>
```

The device name for the TK-50 and TK-70 cartridge tape drives on all of the VAXstations is MUA0:, so if you are backing up files to tape, you can press "carriage-return" to accept the default response.

If you are backing up files to a disk, then you need to enter both the disk name and the directory to be used for the backup; for example,

```
Enter device name that you are using to backup
your files (Default:  MUA0:)
> U1:[SMITH]
```

tells UBACK to backup the files to the U1 disk and the [SMITH] directory.

If you enter a device name in response to this prompt, it is necessary to include the colon at the end of the name. Also, UBACK assumes that tape device names begin with the letter "M", and that all other device names are disk type devices. This assumption may not be valid if you try to use UBACK on a VAX that is not in Department 9140.

After you enter the device name, you are prompted with

```
What files do you want to backup?

 0 = Quit
 1 = All files and directories
 2 = All files in the current directory
 3 = All files modified since last backup (default)
 4 = Specific files
>
```

The first choice, "1", backs up all files in all of your directories, in other words, it performs a full backup. It will only back up files on your current disk. If you have files on another disk, you will have to set your default directory to one on that disk and run UBACK again.

The next choice, "2", only backs up the files in your current directory. This option is useful when you want to transfer files to another VAX with tape (you only need to use tape when the other VAX cannot be accessed over the network). You can copy all files in a directory to tape, and then restore them to disk on another machine. When you restore the files, you will probably have to use the VAX backup commands since other VAX's may not have the UBACK procedure, or they may have a different UBACK procedure.

The default choice, "3", backs up all new and modified files since the last backup, that is, it performs an incremental backup. Each time you back up files, the backup date is recorded as part of the file. This allows the system to easily determine which files are new or modified since the last backup. The only exception is that the incremental backup always backs up directory files (files associated with subdirectories).

The last choice, "4", lets you write specific files to a backup tape. This option, like Option 2, is useful when you want to transfer one or two files to another VAX not on the network. If you select Option 4, you will be prompted with

```
Enter files that you want backup up
>
```

You can enter one or more filenames (each filename must be separated with a comma), and you can use the asterisk to act as a "wildcard" to specify a group of files. The list of files cannot have spaces (or blanks) in it; this will cause the backup command to fail. You can include disk and directory specifications as part of the filenames.

If you are backing up your files to a tape device, one that starts with "M", the next prompt is

```
Select a tape initialization option:

 0 = Quit
 1 = Initialize tape
 2 = Add files to tape (default)
>
```

The first option, "1", initializes the tape before the files are copied to it. This erases all information on the tape, so you need to be careful that you do not destroy something useful. This option must be used if you are using a tape for the first time, and it is usually used when you are making a full backup.

The next option, "2", does not initialize the tape so the new files are added to the end of the tape. If you have backed up files to the tape previously, they are not destroyed. This option can be used for incremental backups, allowing you to use the same tape for several backups.

The next prompt is for the "save-set" name, that is,

```
Enter "save-set" name for the files being
backed up (Default:  date.BCK)
>
```

where *date* is the current month and day. When you use the VAX backup utility, it takes all of the files that you want backed up and puts them in a single file. It also records the filenames and some information that helps it recover the files if the tape is damaged. The backup file, like all other files, has a filename called the "save-set" name.

The save-set name is usually the date the files were backed up, or it can be a name that describes the files being backed up. It generally has the file type .BCK although this is not a requirement. Only one save-set name is used for each backup operation (each time you use UBACK).

It is important that you remember the save-set names that you use for backups, because you will need the names if you want to recover or restore files.

UBACK can back up the files interactively or with a batch job, so the next prompt is

```
Select type of backup job:
```

```
 0 = Quit
 1 = Batch (default)
 2 = Interactive
>
```

Most of the time, you can back up your files with a batch job. This way you can logout or perform other tasks while the backup job is running. However, if you have too many files to fit on one tape, then you must run interactively so the backup utility can prompt you to insert the next tape. When you run interactively, you have to stay logged in while it copies the files. Since this takes a long time, you can shrink the window to an icon so it does not clutter your screen.

If you select "1" to back up with a batch job, then you will be prompted with

```
When you do want to run the batch job?
(Default:  Now)
>
```

This prompt lets you delay execution of the batch job until after normal working hours; for example, if you want to wait until 8:00PM to run the backup job, then you can respond with

```
When you do want to run the batch job?
(Default:  Now)
> 20:00
```

The time is given using the 24-hour clock, so 20:00 corresponds to 8:00PM. The batch job is held in the machine until 8:00PM, and then it starts to run and back up your files.

If you are backing up to tape, one last prompt is displayed reminding you to insert the tape in the drive, that is,

```
If you are using TK-50 tapes, insert the cartridge
in the tape drive and press the red button.  When
you get the green light, press "carriage-return".

If you are using a different tape, then you
need to mount the tape and put the device on-line.
Then press "carriage-return" to continue.
```

When you insert a TK-50 tape into a VAXstation, it is easy to forget to press the red button. If you do not press the button, the tape is not put on-line and the backup job will fail. So this prompt is given to remind you that you need to get the tape ready.

When you press "carriage-return" to continue, UBACK displays the message

```
Starting backup procedure...
```

Then it either starts the backup procedure or it submits a batch job. If a batch job is used, a "log" file is saved in your home directory called BACKUP.LOG. This file will have a list of the files that were backed up, so you may want to print and save it.

5.2. Restoring files

When you select "2" from the main menu to restore files, the first prompt is for the backup device name, that is,

```
Enter device name that you want to restore files
from (Default:  MUA0:)
>
```

The device name for the TK-50 and TK-70 cartridge tape drives on all of the VAXstations is MUA0:, so if you are restoring files from tape, you can press "carriage-return" to accept the default response.

If you are restoring files from a disk, then you need to enter both the disk name and the directory containing the backup save-set file; for example,

```
Enter device name that you want to restore files
from (Default:  MUA0:)
> U1:[JONES]
```

tells UBACK to restore files from the U1 disk and the [JONES] directory.

If you enter a device name in response to this prompt, it is necessary to include the colon at the end of the name. Again UBACK assumes that tape device names begin with the letter "M", and that all other device names are disk type devices.

After you enter the device name, you are prompted with

```
What files do you want to restore?

 0 = Quit
 1 = All files to original directories (default)
 2 = All files to current directory
 3 = Specific files to current directory
>
```

The default choice, "1", tries to restore all files in a save-set to their original directories on your current disk. This option is used when you are restoring a large number of files that do not exist on a disk or when you are restoring a disk that failed.

The next choice, "2", tries to restore all files in a save-set to your current default directory. Even though the files in the save-set may have been located in subdirectories, they are restored to your current directory. This option is generally used when transferring files between machines with backup tapes.

The last choice, "3", tries to restore specific files in a save-set. This option is generally used to restore one or two files that were accidentally deleted. If you select Option 3, you will be prompted with

```
Enter files that you want restored
>
```

You can enter one or more filenames (each filename must be separated with a comma), and you can use the asterisk to act as a "wildcard" to specify a group of files. The list of files cannot have spaces (or blanks) in it; this will cause the restore command to fail. You can include directory specifications as part of the filenames.

The next prompt, given below, is for a file replacement option:

```
Select a file replacement option:

 0 = Quit
 1 = Restore files only if they do not exist (default)
 2 = Restore all files and make new version
 3 = Restore all files and replace identical versions
>
```

This option controls what happens when a filename in the save-set (on the backup device) is identical to one that already exists. The filename must be identical, that is, the same directory, filename, file type, and version.

The default file replacement option, "1", does nothing if the file already exists. It assumes that you only want to restore files that do not already exist. The next option, "2", restores all files and if an identical filename already exists, it creates a new version of the file. Finally, the last option, "3", restores all files and if an identical filename exists, it replaces the file with the one from the save-set (the backup device).

After you enter the file replacement option, you are prompted with

```
Enter "save-set" name for the files being
restored (Default:  date.BCK)
>
```

where *date* is the current month and day. The save-set name must be the one used when the files that you are restoring were backed up. If you cannot remember the save-set name, you can use the "3 - List files" option from the main menu to list the save-sets and files.

All information for the restore option has been entered, but you must still tell UBACK whether you want the restore operation to be done interactively or with a batch job. Thus, you are prompted with

```
Select type of restore job:

 0 = Quit
 1 = Batch (default)
 2 = Interactive
>
```

Most of the time, you can restore your files with a batch job. This way you can logout or perform other tasks while the restoration job is running. The restore operation can take a long time when using tapes, even if you are only restoring one or two files. The TK-50 tapes are slow, and they must be scanned for the files that you want to restore.

If you select "1" to backup with a batch job, then you will be prompted with

```
When you do want to run the batch job?
(Default:  Now)
>
```

This prompt lets you delay execution of the batch job until after normal working hours; for example, if you want to wait until 9:30PM to run the restore job, then you would respond with

```
When you do want to run the batch job?
(Default:  Now)
> 21:30
```

The time is given using the 24-hour clock, so 21:30 corresponds to 9:30PM. The batch job is held in the machine until 9:30PM, and then it starts to run and restore your files. Usually you want your files restored now, so you can just press "carriage-return" to start the job running immediately.

If you are restoring from tape, one last prompt is displayed reminding you to insert the tape in the drive, that is,

```
If you are using TK-50 tapes, insert the cartridge
in the tape drive and press the red button.  When
you get the green light, press "carriage-return".

If you are using a different tape, then you
need to mount the tape and put the device on-line.
Then press "carriage-return" to continue.
```

When you press "carriage-return" to continue, UBACK displays the message

```
Starting restore procedure...
```

Then it either starts the restore procedure or it submits a batch job. If a batch job is used, a "log" file is saved in your root or home directory called BACKUP.LOG. This file will have a list of the files that were restored confirming that it worked correctly.

5.3. Listing files on a backup device

If you forget the save-set names or files on a backup tape, you can list them by selecting "3" from the main menu. When you select "3", the first prompt is for the backup device name, that is,

```
Enter device name that you want to list save-set
names and files from (Default:  MUA0:)
>
```

This is the same prompt shown previously. The device name for the TK-50 and TK-70 cartridge tape drives on all of the VAXstations is MUA0:, so if you have used tape to back up your files, you can press "carriage-return" to accept the default response.

If you have backed up files to a disk, then you need to enter both the disk name and the directory used for the backup; for example,

```
Enter device name that you want to list save-set
names and files from (Default:  MUA0:)
> U1:[BROWN]
```

tells UBACK to list the files backed up on the U1 disk and the [BROWN] directory.

If you enter a disk backup device, you are prompted with

```
Enter "save-set" name for the files being
listed (Default:  date.BCK)
>
```

where *date* is the current month and day. The save-set name must be the one used when the files were backed up. This will also be the filename on the disk containing the backed up files. If you enter a tape backup device, all save-sets on the tape are automatically listed.

The list operation can be run interactively or with a batch job, so you are prompted with

```
Select type of list job:

 0 = Quit
 1 = Batch
 2 = Interactive (default)
>
```

The default list operation is interactive, because you usually want to know what is on a tape as soon as possible. When selecting the type of job, you must also consider that the files are listed on the screen for an interactive job, and they are listed on a file for a batch job.

If you select "1" to list the files with a batch job, then you will be prompted with

```
When you do want to run the batch job?
(Default:  Now)
>
```

Again this prompt lets you delay execution of the batch job until after normal working hours; for example, if you want to wait until 8:00PM to run the list job, then you would respond with

```
When you do want to run the batch job?
(Default:  Now)
> 20:00
```

The time is given using the 24-hour clock, so 20:00 corresponds to 8:00PM. The batch job is held in the machine until 8:00PM, and then it starts to run and list your files.

If you are listing files from tape, one last prompt is displayed reminding you to insert the tape in the drive, that is,

```
If you are using TK-50 tapes, insert the cartridge
in the tape drive and press the red button.  When
you get the green light, press "carriage-return".

If you are using a different tape, then you
need to mount the tape and put the device on-line.
Then press "carriage-return" to continue.
```

When you press "carriage-return" to continue, UBACK displays the message

```
Starting list procedure...
```

Then it either starts the list procedure or it submits a batch job. If a batch job is used, a "log" file is saved in your home directory called BACKUP.LOG. This file will have a list of the save-sets and files on the backup device.

6. VAX Network

The CAE workstations in Department 9140 are connected with Ethernet forming a Local-Area VAX Cluster (LAVC) as shown in Figure 24. The Ethernet hardware provides a high-speed communications link between systems that are located relatively close together (in one building). It does not provide security, so Ethernet cannot be used for classified processing unless the entire network is inside a secure area.

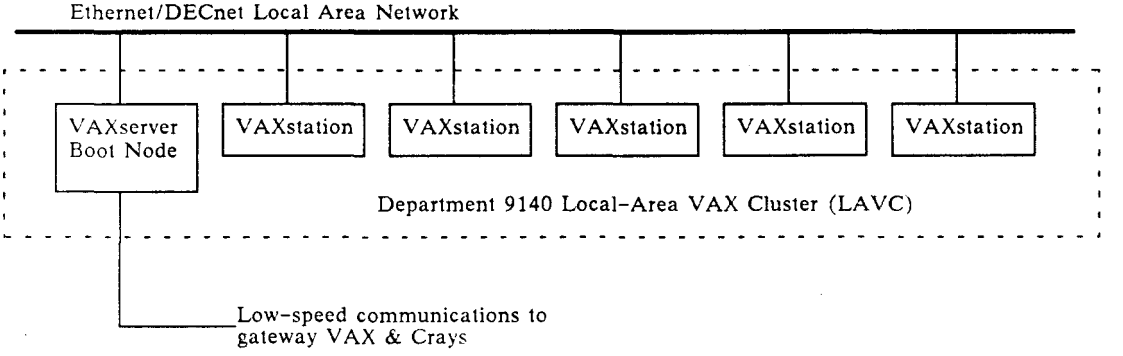

Figure 24. Department 9140 Network Configuration

Workstations in an LAVC share software, disks, tapes and printers. A special computer, called a VAX server or "boot node", is used to manage the LAVC and network. The server contains the operating system and application software (VMS, ANVIL-5000, IDEAS, etc.). Workstations access the software over the Ethernet network.

Ethernet is only used to connect the workstations in Department 9140 together. Communications with other VAX systems at Sandia is provided with a low-speed line from one of the VAXstations to the "gateway" VAX. Since the gateway VAX is connected to all other VAX's on the Sandia secure network and to the Crays, this lets the VAXstations communicate with these systems.

The software protocol used on the network to communicate between the VAX systems is called DECnet. It lets you copy files between VAX systems, and it lets you login to any VAX system on the network provided you have an account. Special software developed by Organization 2600 at Sandia is available to communicate with the Crays. This software lets you login to the Crays interactively or to submit batch jobs.

This section explains how to use some of the basic features of the network, such as copying files between machines, sending mail messages, and logging into other systems. Use of the Cray from the VAXstations is discussed briefly, and references are given for more information.

6.1. Mail Utility

The VAX mail utility is used to send short messages or text files to other VAX users on the network. You also use it to read messages sent by other users. This section shows you how to send a message and how to read messages sent to you. The mail utility has many other features that are documented in Reference 1.

To send a mail message to another user, you need to know the machine he works on and his user name. Then you start the mail utility with the command

```
$ MAIL
```

This puts you inside the mail utility. When you are inside the mail utility, prompts are given by MAIL>. To exit the mail utility, you can type the EXIT command, and if you want to access the on-line help information, you can type the HELP command.

Sending messages

To send a message, you can create a text file with one of the text editors and then send the file, or you can use the mail utility to create a message. If the message is long, it is easier to create a file, but if the message is short (a paragraph), then it is easier to use the mail utility.

To send a message in a text file, for example the file MSG.TXT, to another user, you use the following commands:

```
MAIL> SEND  MSG.TXT
To:  SAV29::JONES
Subj:  An example message
MAIL>
```

The SEND command contains the name of the text file that you want to send. This file should always contain text; you should not try to send a binary file to another user.

Next the SEND command prompts you for the user name that you want to send to, in this case, it is the user JONES on the machine SAV29. Double colons are used to separate the workstation and user names. The machine name does not need to be provided if the user works on one of the CAE workstations in the cluster. It only needs to be provided when sending mail to a VAX system that is not part of the LAVC.

Finally, the SEND command prompts you for a "subject". This is an optional brief description of your mail message. After you enter the subject, the mail message is sent.

A short message can be sent using the mail utility by not including a filename as part of the SEND command, for example,

```
$ MAIL
MAIL> SEND
To:  SMITH
Subj:  An example message
Enter you message below. Press CTRL-Z when complete, or CTRL-C to quit:
This is a short message to the user SMITH on another
workstation.  When the message has been typed in,
you need to hold the "Ctrl" key down and press
the "Z" key.
CTRL-Z
MAIL> EXIT
$
```

Using the technique shown above, the mail utility does not provide you with a text editor; it just lets you type in some lines. If you decide to change the message after you have typed part of it, then you need to use "control-c" to get back to the MAIL> prompt, and then start over with the SEND command. Methods are given in Reference 1 showing how to access an editor, such as EDT, within the MAIL utility for sending messages.

Receiving messages

If someone has sent you a mail message, you will see a message displayed when you login that you have one or more new mail messages. When you enter the MAIL command, you may also receive a message that you have some "new" messages.

To read the first message, just press "return" immediately after the MAIL> prompt, for example,

```
$ MAIL
MAIL> "return"
```

```
     #1          12-FEB-1989     12:56:39
From:  SYSTEM
To:    DESALGU
Subj:  A mail message

This is a typical mail message displayed after pressing
the "return" key.  After reading this message, you can
press the "return" key again to read the next message.
Continue until you have read all messages.

MAIL>
```

If you have received one or more new messages, the first one is displayed. If you have not received a new message, then it displays the first old message still available.

After you read a message, its status is changed from "new" to "old". Old messages are kept until you delete them. Periodically you should delete your old mail messages with the command

```
MAIL>  DEL/ALL
```

When you exit the mail utility, this command removes all old mail messages.

6.2. Access to other VAX Systems

The Sandia VAX network lets you login over the network to other VAX systems and the Crays. It also lets you copy files from other VAX systems and the Cray. Since all of the VAXstations on the Department 9140 network are unclassified, you can only access other unclassified systems. A special method has been setup for sending files to and from drafting and the shop, since their machines are considered classified even though the files being transferred are unclassified.

Logging into other CAE workstations

When your account is set up, you automatically have accounts on all of the CAE workstations in Department 9140. So you can login to any of the workstations over the network from your workstation. Then any commands that you execute are done on that machine. The most common use of this feature is to use a tape drive on another workstation to back up files.

When you are on another workstation, you can enter any command and run any program except those that use the workstation software (for windows and graphics). Graphics does not get transmitted across the network, so programs such as ANVIL-5000 and EGS cannot be run on another workstation.

To login to another workstation, you should use the SETHOST procedure as shown below:

```
$ SETHOST  SAV188

     Property of Sandia National Laboratories
        Unauthorized Access is Prohibited

Username: DESALGU
Password:

 Welcome to the Department 9140 Local-Area VAXCluster

   Last interactive login on Thursday, 16-FEB-1989 13:05
   Last non-interactive login on Friday, 28-OCT-1988 03:45

$
```

This is the same login procedure shown in Section 2 except you continue to work in the same window. If you enter a command after the dollar sign prompt, the command is sent over the network to SAV188, executed, and the response is sent back to your machine and displayed in your terminal window. It appears just like you are working directly on the other machine. Again the only restriction is that you cannot run a graphics program such as ANVIL-5000, IDEAS, or Interleaf. When you are finished working on the other machine, you use the logout command, LO, to return to your machine.

The window banner is changed to indicate the workstation that you are currently logged into. This helps you remember that you used SETHOST to use another machine. When you logout it is changed back to the name of your own workstation.

Logging into other VAX systems

If you have an account on another VAX system at Sandia, you can login to it from your workstation with the SET HOST command. This is the same as the SETHOST command except that it has a space between SET and HOST. It works that same way as SETHOST except that it does not change the window banner.

Also, you will notice that response is much slower than normal because the commands have to be routed over the low-speed line to the other VAX. This is not

normally a problem except when editing with EDT, EVE or SLEM. The response while editing is so slow that it is not usable.

Copying files from other VAX systems

If you only want to list files or copy files from another machine to your machine, you do not have to login to the other machine. Instead you can use the DIR or COPY commands to perform these tasks.

To list files on another machine, you just need to supply the machine name, the disk, and the directory following the DIR command, for example, the command

```
$ DIR  SAV08::A1:[SMITH.DATA]
```

lists the files on the machine SAV08, on the disk A1, and in the directory [SMITH.DATA]. The file protections, including the directory files, must be set up for "public" access or the DIR command will give an error message stating that you have "insufficient privilege" to access the files. You can use the PUBLIC command as shown in Section 4.3 to change the file protection.

If the machine you are listing or copying from is a CAE workstation on the LAVC, then you do not need to provide the machine name. Each disk in the cluster has a unique name so you only have to provide the disk, directory and filenames.

The first step to copy a file is to set your default directory to the directory that you want the file copied into. You can use any of the commands shown in Section 4.2 to set your default directory. Often you are already working in the directory that you want the file copied into, so you do not have to do anything.

Then you use the COPY command and fully specify the file that you want to copy; for example,

```
$ COPY  SAV29::UD1:[DESALGU.PRG]FILE1.DAT  *
```

copies a file called FILE1.DAT in the directory [DESALGU.PRG] on the disk UD1 on the machine SAV29 to the current default directory.

Copying files to drafting

The copy command shown above works for all unclassified VAX systems on the Sandia secure network. However, the VAX systems used in drafting are classified systems even though many of the files on these systems are unclassified. To get around this problem, a directory was set up on one of our workstations that can be

accessed by drafting. Mark Geertz in drafting has set up special controls so that only unclassified files can be copied to our workstations.

The procedure used to copy files to and from drafting is illustrated in Figure 25. If, for example, you want to copy a file to drafting, you need to copy the file to the special drafting directory, and then call drafting and have them copy it from this directory. Similarly, if you want to copy a file from drafting, you need to call them and have them copy the file to the special directory. Then you can copy the file from this directory to your own directory. The special directory acts as a "holding" area for the files.

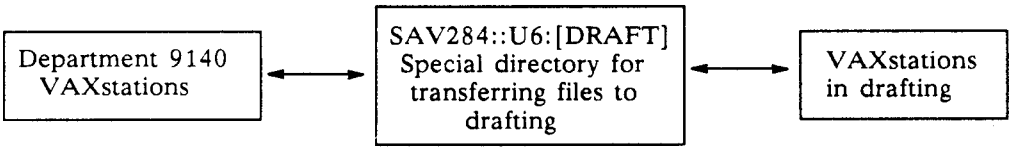

Figure 25 ˜ Network Communications to Drafting and Shop

The drafting directory, as shown above, is called SAV284:U6:[DRAFT]. A special name or alias, "DRAFTING", has been defined on the Department 9140 workstations to be this directory. This makes it easier to remember how to copy files to and from drafting.

To list files in the directory, you can use the command

```
$ DIR  DRAFTING
```

To copy a file to this directory (or to drafting) from your current default directory, you can use the command

```
$ COPY  TESTPART.PRT  DRAFTING
```

This copies the file TESTPART.PRT to the special directory keeping the same filename and file type. After copying a file to the drafting directory, you can use the DIR command to make sure it copied correctly.

To copy a file from the directory (or from drafting) to your current default directory, you can use the command

```
$ COPY  DRAFTING:TESTPRT.PRT  *
```

When you are copying files to and from drafting, you have to coordinate it with the user in drafting. Both of you need to know the filename and the fact that you are using the special drafting directory on our workstations. If you have problems, you need to contact Mark Geertz in drafting or your system manager.

Nearly all files copied to and from drafting are ANVIL-5000 part files containing drawings or geometry. The primary reason Department 9140 uses ANVIL-5000 for mechanical design is for compatiblity with drafting and the shop.

6.3. Access to the Central Site

The central computing site has the mainframe Cray computers, the Integrated Files Storage (IFS) system, and the Output Node with various types of hardcopy devices. All of the workstations have access to these computing resources when connected to the Sandia VAX network. Currently, these resources can only be used from the workstations for unclassified processing.

Logging on the Cray

If you have an account on the Cray, you can login interactively with the DNTS command from a terminal window on a VAXstation, for example,

```
$ DNTS
DNTS V2.3 Oct 10 88  SNLA Distributed Network Terminal Server
User DESALGU  Id E00027033  Case 0005310  Worker CRA3 Gateway
SAVG1:: Class U
 SNLA DNTS Status at 20-FEB-1989  15:38:14.69
 DNTS link to AVS (Access Validation System) is UP.
 DNTS link to CTSS on CRA1          is UP.
 DNTS link to CTSS on CRA3          is UP.

 end of status

Enter Password: ____
Login accepted.  Last login at 12/05/88  17:53:48
NTS_SLP Protocal V-5.0
w D/S W/F 02/18/89 18:42:46  xk08
NIL
w 0019.335  ACTIVE A
ccl / 60
CCL - LANL version date 05/16/85, SNLA version date 02/01/88
----- Will attempt to get default subroutine library from cfs.
```

```
mass get ccllibc

/
```

The DNTS command is executed in the terminal window just like other VAX commands. It displays messages similar to those shown above, and then it prompts you for your CTSS password. When you type your password, it is not displayed for security reasons. If you type it correctly, DNTS displays the message "login accepted" and indicates that you are "active".

Before you enter commands on the Cray, you should be sure that the shift lock key is not active because the Cray commands are case sensitive and most are lowercase commands. In this example, the first command on the Cray is "ccl", which activates the "ccl" command language. This command language has many convenient features that make it easier to use than the basic CTSS language. It also prompts you with the slash character, so you know when you can enter another command.

Several manuals are available from Organization 2600 on CTSS. If you have never used CTSS before, you need to read the tutorial (Reference 5) and you probably need to get someone to help you.

When you are finished on the Cray, you can return to the VAXstation session with the "control-c" command, that is, press and hold the "Ctrl" key and then press the "C" key. This logs you off of the Cray and displays the dollar sign prompt for the next VAX command.

Batch jobs on the Cray

The Cray is often used in Department 9140 for processing "number crunching" jobs where no interaction is required. Files can be set up with all of the input data required to run a program, and then they can be sent to the Cray to execute as a "batch" job. When the batch job has finished, the output files can be sent back to the VAXstation.

For example, the Sandiac aerodynamics prediction code and the PMAST trajectory code both can be run on the Cray as a batch job. Pre-processor programs are available on the VAXstations that prompt you for input data and files and then they send the files to the Cray for execution. These programs make it relatively easy to use the Cray; you do not have to learn how to use CTSS. Additional information on these programs is given in Section 12 of this report.

The SENDCTSS command is used on VAX's to send batch jobs to the Cray. Documentation for this command is available on-line with the SHELP command. Unless

you want to run one of your own programs on the Cray, you do not need to use this command. The pre-processor programs that are part of the CAE software do this for you.

The SENDNET command is used on the Cray to send output files back to the VAXstations. Again you do not need to know how to use this command if you use the CAE pre-processors. If you are trying to run your own program, you can get documentation on CTSS with the on-line help command.

The PROD utility can be used to check on the status of batch jobs on the Cray. Before it can be run, you need to obtain permission to use the network by executing the NETON command. Then you can use PROD to check on job status as follows:

```
$ NETON
$ PROD  JOBSTATUS
```

The PROD command is documented further in Reference 6 available from Organization 2600.

Integrated File Storage (IFS)

The Integrated File Storage (IFS) system provides Sandia computer users with a large amount of disk storage for their data files. The system is the primary storage facility for the Crays, and it can be used by VAX's as well. Since it can be accessed by both the Crays and the VAX's, the IFS can be used to transfer files between the systems.

Use of the IFS is documented in Reference 7, which is available from Organization 2600. Before you can use it from the VAXstations, you must execute the NETON command, for example,

```
$ NETON
000 Enumber=E00027033   class=U   case=0005310   box=034
001 You are now authorized
$
```

This command makes sure that you have a CTSS account and that the communication link to the IFS is operational. After the NETON command displays the message that you are "authorized", you can enter the command

```
$ MASS
?
```

This gets you into the IFS, where you can store and retrieve files as shown in Reference 7. The IFS prompts with a question mark as shown above. When you want to return to the VAX, you use the command

```
? END
$
```

If you do not need to use the IFS again, you can use the command

```
$ NETOFF
```

to turn off the network connection. You can always execute NETON again to get access to the IFS.

Transferring files to the Cray

The IFS can be accessed from the VAXstations and from the Crays with similar commands. So you can store a file from the VAXstation on the IFS, login to the Cray, and then retrieve the file on the Cray. The only problem is that text files on the VAX and on the Cray use different character sets, so VAX files cannot be used directly by the Cray. Binary files on the two machines also have different forms so they have to be converted.

Organization 2600 has provided utilities, called VAX2CTSS and CTSS2VAX, to convert text files from the VAX character set to the Cray character set and vice-versa. These can be run on both the VAX and Cray; however, they run faster on the Cray. On-line documentation for these two utilities is provided on both the VAX and Cray systems.

The result is that you can store a VAX file on IFS, retrieve it from IFS on the Cray, and then convert its characters for use by the Cray with VAX2CTSS. Or you can convert a Cray file to VAX characters with CTSS2VAX, store the file on IFS, and then retrieve it from IFS on a VAXstation.

Other utilities, called STEXT and NTEXT, have been developed by Organization 2600 to convert both VAX and Cray character sets to a third character set called "standard" text. This set can then be converted to the CYBER or IBM character sets as well as the VAX and Cray character sets. However, if you are only transferring files between the VAX and Cray, the VAX2CTSS and CTSS2VAX utilities are easier to use.

Conversion methods are available for binary files, but they are not used often. If you need them, you should contact the consultants in Organization 2600.

Creating Microfiche

If you have a text file, such as a printout file from an analysis program, that you want stored on microfiche, you can send it to the "Output Node" at the central site. The microfiche is produced and mailed to your output box (for Department 9140 this is in the south end of Building 634). It takes about two to three days for the microfiche to be produced and mailed.

Currently you can only microfiche text files. Two commands are required: the first reformats the file for the output node, and the second sends the file over the network to the central site. For example, the commands

```
$ REFORM  FILE1.TXT  FILE2.TXT

$ ONODE  QUEUE  FILE2.TXT  TITLE1=title, OUTPUT=48FICHE
```

convert the file FILE1.TXT to FILE2.TXT which is sent to the output node. The file FILE2.TXT has the same information as FILE1.TXT, but it is in the format for the output node. The ONODE command sends the file FILE2.TXT to the output node, and it writes *title* in the title block of the microfiche.

7. Other VAX Features

So far only the basic features of the VAX have been given such as how to copy and edit files. This section gives you an overview of some other VAX features, such as command procedures, the "login" file, and programming.

Command procedures

If you want to execute the same series of VAX commands (DCL commands) several times you can write a "command procedure". A command procedure consists of a text file containing lines with commands. You use one of the text editors, such as EVE, to create a command procedure file. Usually command procedure files have the file type ".COM". When you tell the VAX to run a command procedure file, it executes each VAX command given in the file.

An example of a command procedure file is given below:

```
$!
$!  This is an example command procedure file
$!
$ ASSIGN  INPT.DAT  FOR002
$ ASSIGN  OUT.DAT   FOR003
$!
$ RUN  U1:[DESALGU]TEST.EXE
$!
$ PRINT OUT.DAT
```

All of the lines in a command procedure begin with the dollar sign, which is the default VAX command prompt. The lines with a dollar sign and an exclamation point are comment lines. They are ignored by the VAX.

The first lines with VAX commands are those containing the ASSIGN commands. These commands associate the file INPT.DAT with the FORTRAN unit number 2 and the file OUT.DAT with the FORTRAN unit number 3. Thus, the program that is run in the next command "RUN U1:[DESALGU]TEST.EXE" reads from unit number 2 or the file INPT.DAT and writes to unit number 3 or the file OUT.DAT. The last command prints the file OUT.DAT.

If this command procedure is stored in the file TEST.COM, it can be executed with the command

```
$ @TEST.COM
```

The "@" symbol is used to execute command procedures. Since the default file type for command procedures is .COM, this procedure could be executed with the command "@TEST".

Command procedures have many features which are documented in Reference 1. One of the more useful ones is command procedure arguments. In the procedure given above, you may want to execute the program with different input and output filenames. By using the special symbols P1 and P2 for the input and output filenames, you can specify the filenames when you execute the procedure.

For example, if you modify the procedure to look like

```
$!
$!  This is an example command procedure file
$!
$ ASSIGN  'P1'  FOR002
$ ASSIGN  'P2'   FOR003
$!
$ RUN  U1:[DESALGU]TEST.EXE
$!
$ PRINT OUT.DAT
```

and if you run the procedure with the command

```
$ @TEST  INPT2.DAT  OUT2.DAT
```

then the name INPT2.DAT is substituted for P1 and the name OUT2.DAT is substituted for P2. The special symbol P1 is associated with the first item following the procedure name and P2 is associated with the second item following the name. You should refer to Reference 1 for more information on command procedure arguments.

One trick that you need to be aware of when writing command procedures is to always include the following command just before running any interactive program:

```
$ DEFINE/USER_MODE  SYS$INPUT  SYS$COMMAND
```

Interactive programs are those that read information from the keyboard and write to the screen (in FORTRAN they are programs that use READ(*,) and WRITE(*,) statements). This VAX command causes the programs to work properly inside a command procedure. If you forget to included it in the procedure file, the program will not work properly.

For example, if the program shown above is interactive, then the procedure needs to be modified to look like

```
$!
$!  This is an example command procedure file
$!
$ ASSIGN  'P1'  FOR002
$ ASSIGN  'P2'   FOR003
$!
$ DEFINE/USER_MODE  SYS$INPUT  SYS$COMMAND
$ RUN  U1:[DESALGU]TEST.EXE
$!
$ PRINT OUT.DAT
```

Any VAX command can be used inside a command procedure. This includes running other command procedures from inside a command procedure. You can also have IF statements and loops inside command procedures. You should refer to Reference 1 for information about these features.

Login procedures

Each time that you login to the VAX, it automatically executes some command procedures that set up special commands. The last command procedure that it tries to execute is a file called LOGIN.COM located in your main directory. This is a file that you can edit to define your own special commands.

A typical login procedure contains a command to set the default file protection for any new files that you create and commands to define some special symbols that you can use to run programs.

For example, the LOGIN.COM file shown below

```
$!
$ SET PROT=(S:REWD,O:REWD,G:RE,W:RE) /DEFAULT
$!
$ MIKE == "SET DEFAULT U1:[SMITH.MIKE]"
$ PGM == "@U1:[SMITH.PROGRAM]PGM.COM"
$!
```

sets the default file protection and defines two special commands. If you type in "MIKE", the VAX runs the command "SET DEFAULT U1:[SMITH.MIKE]". If you use this command a lot, it is easier to type MIKE than the full command. Similarly, if you type "PGM", it executes the command procedure file "U1:[SMITH.PROGRAM]PGM.COM".

Programming

All of the VAXstations in the Department 9140 cluster have FORTRAN installed. Some of them also have BASIC or C installed. If you need to use BASIC or C, you should see the system manager and he can tell you which machines have it installed. You can use the SETHOST command to compile on that machine. This manual only discusses FORTRAN programming.

To write a FORTRAN program, you use one of the text editors, such as EDT or EVE, to create a file containing the FORTRAN statements. VAX FORTRAN is documented in Reference 8. It contains all of the FORTRAN-77 features plus many extensions.

Then you need to compile and link the program before you can execute it. The standard file type for FORTRAN files is ".FOR". If you use this file type for FORTRAN files, then you can avoid entering the file type when you compile the program.

To compile a FORTRAN program saved in the file TEST.FOR, you use the command

```
$ FORTRAN  TEST
```

This converts the FORTRAN statements in the file TEST.FOR into a binary "object" file called TEST.OBJ. It also checks the program for errors and lists them on the screen. If it has FORTRAN errors, then you need to edit the program and correct it.

If the program does not contains FORTRAN errors, then you need to link it with the command

```
$ LINK  TEST
```

This command uses the file TEST.OBJ to create a file called TEST.EXE. The file TEST.EXE is called an "executable" file, and it can be run with the standard VAX "RUN" command, that is,

```
$ RUN  TEST
```

If you have used the FORTRAN statements READ(*,) and WRITE(*,) for input and output, then the input will be read from the keyboard and the output will be displayed on the screen.

There are many optional features for both the FORTRAN compiler and the linker. One common option produces a file containing a listing of the FORTRAN program

which can be printed. Another option uses a different form of floating point numbers that extends the range of valid numbers.

To produce a listing file, use the command

```
$ FORTRAN/LIST/CROSS_REFERENCE  TEST
```

This command creates the standard object file TEST.OBJ and a listing file TEST.LIS. The listing file will contain each line of the FORTRAN source, its line number, any FORTRAN errors, and a list of all variable names and their location in the program called a "cross reference map". The cross reference map is useful to see if you have used undefined variables. The file TEST.LIS is formatted for the laser printers, so you can use the command

```
$ PRINT  TEST.LIS
```

to print it.

The standard range of single precision floating point numbers on the VAX is from approximately 10^{-38} to 10^{38} and the precision is only about 6–7 digits. Consequently, most people define all variables in FORTRAN programs to be double precision with an IMPLICIT statement. This increases the precision to 13–14 digits, which is comparable to single precision on the Cray.

However, you need to use the "G_FLOAT" compiler option to extend the range of double precision numbers from approximately 10^{-308} to 10^{308}. So for any programs where numerical precision is required, you should use the command

```
$ FORTRAN/G_FLOAT  TEST
```

to compile. This should be used for most engineering analysis programs.

Interactive debugger

Probably the most useful programming feature of the VAX is its interactive debugger. This lets you run your program in the "debug" mode so you can stop execution and examine the values of variables. It is very useful for debugging programs and can save hours of time.

To use the interactive debugger, you need to include some options when you compile and link. When you compile, you need to use the command options

```
$ FORTRAN/NOOPT/DEBUG  TEST
```

and when you link, you need to use the command

```
$ LINK/DEBUG  TEST
```

Then when you run the program, it creates a new window for entering debugging commands. Commands for the FORTRAN debugger are given in Reference 8.

In a typical debugging session, you want to set one or more "breakpoints". If a breakpoint is hit during execution, the program stops and lets you enter more debugging commands. To set breakpoints, you want to list the FORTRAN statements on the screen with the "type" command

```
DBG> T 100:130
```

which lists lines numbered 100 through 130. Then you can set a breakpoint with the command

```
DBG> SET BREAK %LINE 125
```

So when line number 125 is reached, the program stops execution and lets you enter more debugging commands. To start the program executing, you need to enter the "go" command, that is,

```
DBG> G
```

The program will run until the first breakpoint is hit or until it needs input data from the keyboard. One confusing part of the debugger is that debugging commands must be entered when the keyboard is associated with the debug window, and program input data must be entered when the keyboard is associated with the terminal window. So when you are debugging interactive programs, you need to use the "cycle" key (function key F5) to switch between the terminal and debug windows.

When the program stops at a breakpoint, you can look at the values of variables, for example, the command

```
DBG> E  X2
```

requests the debugger to display the current value of the variable "X2". You can also have the debugger execute the next line in the program by entering the "step" command, that is,

```
DBG> S
```

This command lets you run your program one line at a time. It is useful to check to flow of "IF" statements and loops. When your program is done or when you want to stop debugging, you use the "exit" command

```
DBG> EXIT
```

There are many other debugging commands shown in Reference 8, but these are the most common.

Libraries

Libraries contain sets of subroutines that you can access from a FORTRAN program. These subroutines have been compiled previously, and the object code for each subroutine has been stored in a single file. When you write a FORTRAN program, you can call these subroutines without actually including them as part of the program. But you must include them when you link the program to create an executable as shown in Figure 26.

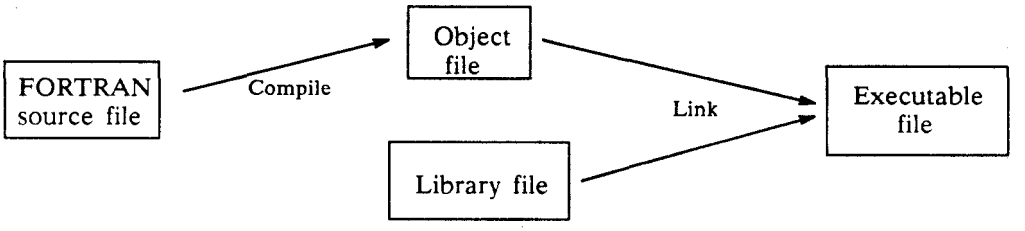

Figure 26 ~ Linking Programs with Libraries

Two types of libraries are available on the Department 9140 VAXstations: graphics libraries, and numerical analysis libraries. Some of these libraries were developed at Sandia, and others were purchased from commercial vendors.

Graphics libraries

One of the most common libraries used on VAX systems at Sandia is the DISSPLA graphics library purchased from Computer Associates. The DISSPLA library includes several hundred subroutines that can be used to make attractive drawings, plots, and viewgraphs.

The subroutines are documented in Reference 9 along with some examples. The DISSPLA library can be included when you link a program by including the special symbol LINK_DISS. Version 10.5 of DISSPLA is currently installed on the Department 9140 VAXstations. DISSPLA will be upgraded as new versions are released.

The DISSPLA library is device-independent, in other words, the subroutines in it can be used with any hardcopy device or terminal. The DISSPLA subroutines call

other subroutines called "device drivers" that are available in other library files. When you link a program with the DISSPLA library, you must also include one of the device driver libraries or it will not work correctly.

The device driver libraries at Sandia are called the Virtual Device Interface (VDI) libraries, and they are documented in Reference 10 available from Organization 2644. These libraries, which were developed at Sandia, are available for many different hardcopy devices and terminals. A subset of these libraries, listed below, is available on the Department 9140 VAXstations:

Device Name	Description
CLA	Calcomp 5912 (A-size media, landscape mode)
CLB	Calcomp 5912 (B-size media, landscape mode)
CPA	Calcomp 5912 (A-size media, portrait mode)
CPB	Calcomp 5912 (B-size media, portrait mode)
F8T	Dichomed 8 x 10 color viewgraphs
GPX	VAXstation color workstation
IWS	Interleaf desktop interface
MET	Sandia VDI meta-file interface
QMS	QMS Model 800 laser printer
T05	Tektronix 4105 terminal
T90	Talaris 1590 laser printer

Each device has a three letter code used to identify the device driver library. The special symbol used to link with one of these libraries is in the form

```
LINK_xxx
```

where *xxx* is the three letter device name. For example, the symbol LINK_GPX is used when linking a program to display graphics on the VAXstation.

To link a program with DISSPLA, you need to add the special symbols for the DISSPLA library and the device driver library. For example, the commands to compile and link the FORTRAN program EXAMPLE.FOR are

```
$ FORTRAN  EXAMPLE

$ LINK  EXAMPLE,'LINK_DISS','LINK_GPX'
```

In this example the VAXstation device driver has been included in the link statement. The apostrophes around the special library symbols are required.

Most of the device drivers produce hardcopy files or they display the graphics on the screen. However, the IWS driver produces a file formatted for an Interleaf document, and the MET driver produces a file that can be post-processed to any of the other devices.

Interleaf is software available on some of the Department 9140 VAXstations for producing reports, memos, letters, and viewgraphs. This manual was produced with Interleaf. Additional information on Interleaf is given in Reference 11.

The MET driver creates a file, usually called FOR055.DAT, that can be converted to any of the other devices by a post-processing program called POST. Many programs using DISSPLA, such as PMAST, are linked with the MET driver because this makes them device independent.

The POST program is executed with the command

```
$ POST  FOR055.DAT  GPX
```

where the first parameter is the meta-file, in this case FOR055.DAT, and the second parameter is the device name, in this case GPX. This command says "post-process the meta-file FOR055.DAT to the VAXstation device", so the DISSPLA plots on the file FOR055.DAT are displayed on the VAXstation screen. Additional information on the POST program can be obtained from the consultants in Organization 2600.

Math libraries

Four different numerical analysis libraries, shown in the list below, are available on the VAXstations. Like the graphics libraries, they are referenced with special symbols when you link a program.

Symbol	Math Library
FXMATH	Math library developed at Sandia (old)
SLATEC	Math library developed at Sandia (new)
IMSLIBS	Single precision IMSL math library
IMSLIBD	Double precision IMSL math library

Documentation for subroutines in the FXMATH and SLATEC libraries is available from Organization 2600. Some documentation is available on-line by entering the command

```
$ HELPMATH
```

Documentation for the IMSL math libraries is available in Reference 12. The VAXstations have Version 10.0 of the IMSL libraries. There are no plans at the present to upgrade the IMSL to the new versions since they are not used very often.

The math libraries are included in a program with the link command; for example, the command

```
$ FORTRAN  TEST

$ LINK  TEST,'SLATEC'
```

compiles and links the FORTRAN program TEST.FOR, and it includes the SLATEC subroutine library. The apostrophes are around the SLATEC symbol are required.

Batch jobs

When commands are executed on the VAX interactively, you type in the command, press the return key, and then wait for it to finish. Similarly, when you execute a command procedure, you type in the command, press the return key, and wait for it to finish. Since command procedure can take a while to execute, you may have to wait several minutes. You cannot enter other commands while one is currently executing unless you create another terminal window.

Command procedures that take a long time to run and require no interaction (they do not require you to enter data from the keyboard) can be executed as "batch jobs". Batch jobs are just like running a procedure interactively except that they are run in the background while you are doing other tasks. You can even logoff the machine and batch jobs continue to run.

So batch jobs provide a convenient way to execute long running programs. If you need to execute a program many times with different input data, you can submit a batch job for each run and then let your VAXstation run the jobs overnight or while you go work on other things.

Only command procedures can be run as batch jobs, so the first step is to create a command procedure file as shown above. Two commands should always be at the beginning of a command procedure that you are going to run as a batch job:

```
$ SET VERIFY
$ SET DEFAULT  default-directory
```

The "SET VERIFY" command lists each command executed in a "log" file so that you know what the batch job did. If this command is not included and the program does not run correctly, it is often difficult to determine exactly what happened.

The "SET DEFAULT" command is also required so that files used in the command procedure are located correctly. If this command is left out, the VAX looks in your root directory for any files that are not fully specified. So you can either include the "SET DEFAULT" command to define a directory and use only filenames in the procedure, or you can leave the "SET DEFAULT" command out and specify the disk and directory as part of each filename. The first method is usually easier.

After you create a command procedure, you can execute it as a batch job with the command

```
$ SUBMIT/LOG=log-file/NOPRINT/NOTIFY  procedure-file
```

where *log-file* is the name of the "log" file and *procedure-file* is the command procedure filename. The log file contains anything that would normally be written to the screen and it contains any error messages. If you do not fully specify the log filename with a disk and directory name, it will be placed in your root directory.

For example, if you have a command procedure in the file JOB.COM, the command

```
$ SUBMIT/LOG=JOB.LOG/NOPRINT/NOTIFY  JOB.COM
```

executes the procedure as a batch job. The log file is in the root directory and is called JOB.LOG.

As with other VAX commands, the SUBMIT command has many options. You can schedule batch jobs to execute at specific times, you can specify which batch queues you want to run on (sometimes this causes the jobs to be run on other workstations), and you can specify command procedure arguments. These options are documented in Reference 1.

8. ANVIL-5000

Software called ANVIL-5000, developed by Manufacturing and Consulting Services (MCS), is used by drafting and the shop at Sandia. This software is also installed on all Department 9140 VAXstations for use by designers so geometry and drawings developed on the workstations can be easily transferred to drafting and the shop. It is documented in a set of manuals published by MCS (Reference 13), and training classes are available.

ANVIL-5000 has five major functions: (1) drafting, (2) numerical control programming, (3) solid modeling, (4) mass properties, and (5) finite-element modeling. It performs the first two functions reasonably well, but is poor for the remaining three functions. For solid modeling and finite-element analysis, Department 9140 has purchased the IDEAS software developed by SDRC. Several Sandia-developed programs are available for mass properties or IDEAS can also be used for this function.

In Department 9140 ANVIL-5000 is used primarily for making and checking drawings and for constructing geometry. It can also compute mass properties on simple shapes (parts that are simple revolutions or projections). This section describes how to execute ANVIL-5000 on the CAE workstations, how to make hardcopy drawings, and how to customize the functions keys.

Starting ANVIL-5000

To start ANVIL-5000 running, you need to enter the following command:

```
$ ANVIL5K
```

When ANVIL-5000 starts up, it uses a file called SIGNON.DAT to determine what type of window to create. Then it either creates a special window for ANVIL or it takes over the entire screen. You have four window options: (1) use a large window, (2) use a medium window, (3) use a small window, and (4) use the full screen.

Sign-on file

The default in Department 9140 is to use a large window. If you want to use a different type of window or the full screen, you need to set up your own SIGNON.DAT file. The first step is to create a special directory and copy the default file with the commands

```
$ HOME
$ CREATE/DIR [.ANVIL]
$ DOWN ANVIL
$ COPY  MCS$ANVILSITE:SIGNON.DAT  *
```

Now you can edit the file SIGNON.DAT with one of the text editors. The file only has two lines in it, and each line has a single number. The first line must always contain the number "2". The number on the second line controls the type of window created, and the following choices are available:

1 - Use full screen
2 - Use a small window
3 - Use a medium size window
4 - Use a large window (the default)

Before you change the file, the second line has a "4" in it. To use the full screen, you need to change this to a "1" and save the file. The next time you run ANVIL-5000 it will use the full screen.

Function key definitions

Similarly, when ANVIL-5000 starts up it defines the function keys as shown below:

F6	CNTL-D	Delete last entity
F7	CNTL-W	Change the way
F8	CNTL-J	Jump to modals
F9	CNTL-F	Main menu
F10	CNTL-P	Point menu
F11	CNTL-L	Line menu
F12	CNTL-A	Arc/circle menu
F13	CNTL-T	Trim/extend menu
F14	CNTL-R	Rebuild display
F15	SHFT-1	Menu item 11
F16	SHFT-2	Menu item 12
F17	SHFT-3	Menu item 13
F18	SHFT-4	Menu item 14
F19	SHFT-5	Menu item 15
F20	SHFT-6	Menu item 16

If you do not like these function key definitions, you can create a file containing your own definitions.

To create your own function key definitions, you need to create a file called BUTTON.TBN in the subdirectory [.ANVIL]. The format of this file is shown in Section 5.2.2 of the 3-D Drafting Manual in Reference 13, and an example follows:

```
BUTTON OVERLAY

65 ^F.N.5.2.2."MCS$ANVILGRPL:ARC-CL"
66 ^F.N.13.2.1.].1.1.].6
67 ^F.N.13.2.1.].4.1.].CR.?].].6
68 Z.13.'11'.].Y.9
69 Z.14.'11'.].
70 ^D
71 ^W
72 ^R
73 ^F
74 ^F.3.3.1
75 ^F.14
76 ^P
77 ^L
78 ^A
79 ^T
80 ^F.16
```

The first two lines of the file are not used, so you can put comments in them. The first column of numbers represent the function keys, so key number 65 corresponds to function key F6, key number 66 is function key F7, and so on. The second column contains the key definition; for example, key number 74 is defined as menu selection 3.3.1 starting from the main menu.

If you have not already created a directory called [.ANVIL], then you need to do so with the commands

```
$ HOME
$ CREATE/DIR  [.ANVIL]
$ DOWN  ANVIL
```

Then you can use one of the text editors to create the button file. After you create the file, the next time you use ANVIL-5000 it will automatically load your function key definitions.

Entering filenames

After ANVIL-5000 creates a window or takes over the full screen, it prompts you for a part name (or filename). All ANVIL-5000 part files have the file type ".PRT" so you only need to provide the filename.

If the file is located in another directory, you must use the greater-than and less-than signs to bracket the directory name instead of the brackets. This is because ANVIL-5000 uses the brackets for special commands. For example, to reference the part file PART1 in the directory U2:[JONES.TMA] you would enter

```
ANVIL-5000 REL/REV 1.2 BY MCS
ENTER PART FILE NAME

U2:<JONES.TMA>PART1
```

This method works with all ANVIL-5000 prompts for filenames.

Menu selections

After a part file has been input, the main ANVIL-5000 menu is displayed. Menu selections can be made from the keyboard or with the mouse. The keyboard selections are made as shown in the ANVIL-5000 documentation (Reference 13).

To make a menu selection with the mouse, you move the mouse pointer until the menu selection that you want is highlighted. Then you press the middle mouse button to make the selection.

The left mouse button can be used in ANVIL-5000 for the "reject" command, and it is equivalent to pressing the "[" key. The right mouse button can be pressed whenever you want to do an "operation complete" command, and it is equivalent to the "]" key.

8.1. Plotting

Drawings from ANVIL-5000 can be made on several hardcopy devices in Department 9140. First you must create a "plot file" inside ANVIL-5000 using the 7.1 menu selection. This results in a binary file of type .PLT containing the pen move and draw commands. This file must be reformatted for a specific hardcopy device before it can actually be used to make a hardcopy drawing.

A special command procedure, called PLOT, has been written by the author to make this easy. This procedure must be executed outside of ANVIL-5000, that is, when you have the dollar sign prompt. So you have two choices: (1) if you are inside ANVIL-5000 and you want to continue working in ANVIL-5000, then you can use menu selection 5.11 to create a special window for executing VAX commands, or (2) you can exit ANVIL-5000 before making hardcopy drawings.

Before you run the plotting procedure you need to know the plot filename (it should be of type .PLT) and the hardcopy device that you want to use. Then you type in the command "PLOT". The window should clear and you will be prompted for the plot filename, that is,

```
Enter an ANVIL plot filename
>
```

After any prompt in the PLOT procedure, you can enter a "Q" to quit or you can enter a "?" to get some additional information about the prompt. If the file type is .PLT, then you do not need to include it as part of the filename.

Hardcopy devices

After you have provided a filename, you are prompted with

```
Select the device that you want to use for plotting:

  1 - QMS-800 Laser Printer
  2 - Talaris-1590 Laser Printer
  3 - Calcomp 5912 Thermal Printer
  4 - Hewlett-Packard Ink Plotter
  5 - Interleaf Publishing Software
>
```

The first two devices produce black and white drawings on A-size paper. The Calcomp can produce black and white or color drawings on A or B-size paper. It can also produce viewgraphs. The ink plotter can produce drawings up to E-size and you can use up to eight different pens or colors. The last choice converts the plot file into the format used by the Interleaf publishing software. This lets you include a drawing from ANVIL-5000 in a memo or report written with Interleaf.

Plot scaling

If you select one of the first three devices, the drawing is automatically scaled to fill the hardcopy page, and you will be prompted with

```
Enter the plot scaling factor (the default is 1.0)
>
```

This prompt lets you change the scaling of the drawing. If you enter 1.0 or press carriage-return to accept the default, the drawing is scaled to fill the page. If you enter 0.5, the drawing is scaled to fill approximately half the page and so on.

One additional option has been provided for drawings of small parts. If you enter the word "FULL", it will try to draw the part full size. Since the paper is only A or B-size, you can only use this option for small drawings.

If you selected the Hewlett-Packard ink plotter, the drawings are always made to the scale given in ANVIL-5000 when you created the plot file. No additional scaling is done by the post-processing program.

Plots are not scaled for Interleaf documents either, since you can use Interleaf to scale the drawings to any size you want.

Calcomp printer

If you selected the Calcomp for plotting, then you will be prompted with

```
Does the Calcomp printer have A or B-size paper loaded?
>
```

The program that reformats the plot data needs to know the size of paper loaded in the Calcomp so it scales it correctly. Normally the Calcomp has B-size paper loaded and a black and white ribbon.

If the Calcomp printer has a color ribbon loaded, then eight colors can be produced. These colors are associated with pen numbers in ANVIL-5000 as shown in the following table:

Pen	Color
1	Black
2	Red
3	Green
4	Yellow
5	Blue
6	Magenta
7	Cyan
8	White

Pen numbers can be assigned to entities in ANVIL-5000. The easiest method is to use a given pen number for entities with level numbers within a specified range.

Hewlett-Packard plotter

If you select the Hewlett-Packard ink plotter, you will also be prompted for the paper size, that is,

```
Enter the paper size for the plot (A, B, C, D, E or O).  If you
select O, then you will be prompted for the origin coordinates
>
```

The paper size on the plotter controls the origin location of the plot, that is, where the plot is located on the paper. If you enter one of the paper sizes (A through E), the origin is automatically set to the lower-left corner of the paper. The coordinates of the origin for each paper size is given below:

Paper Size	X-Origin	Y-Origin
A-size	-2790	-4500
B-size	-7100	-4500
C-size	-9640	-7530
D-size	-15710	-10060
E-size	-20790	-16156

If you enter the letter "O" instead of a paper size, the the PLOT procedure prompts you for the x and y-coordinates of the origin. You can change the origin location so the drawing is located where you want it on the paper, although this will take some experimentation.

Interleaf

If you selected the Interleaf option, you will be prompted for the Interleaf document name to use for the ANVIL-5000 drawing as follows:

```
Enter Interleaf document name that will contain the ANVIL plot
>
```

The next time you run Interleaf, you will have a document containing the ANVIL-5000 drawing with the name given in response to this prompt.

Device-dependent plot files

Regardless of the device that you select for hardcopy, the PLOT procedure creates a new file from the ANVIL-5000 plot file that is formatted for the specific device. It will have the same filename as the ANVIL-5000 plot file, but it will have a different file type. The file types for the different devices are listed below:

Device	File Type

QMS printer	.QMS
Talaris printer	.TAL
Calcomp printer	.CC
HP ink plotter	.HPGL
Interleaf	.IWS

The next prompt gives you the option to save this device specific file or to automatically delete it, that is,

```
Do you want to automatically delete the device-dependent plot
file after processing?  (Default is YES)
>
```

Plot files, especially device-dependent ones, tend to be large so it is recommended that you let the procedure automatically delete these files. Otherwise, it is easy to use up your disk storage with files that can be reproduced.

There is one time that you may want to temporarily save the device-dependent files. This is when you are using the Hewlett-Packard ink plotter, since it may take you several tries to get a good plot. The PLOT procedure looks for a device-dependent file, and if it finds one it will skip the reformatting step to save time.

At this point if you selected any device except the Hewlett-Packard ink plotter, the PLOT procedure begins post-processing the plot file. After the file has been reformatted, it is automatically sent to the nearest printer that you selected.

More on the Hewlett-Packard plotter

Before you can plot on the Hewlett-Packard, you have to set up the plotter, load the paper and load the pens. So the procedure prompts with

```
Make sure the paper is loaded and the plotter is ready.  Then
press carriage-return to start the plotter
>
```

This prompt is provided only to stop the PLOT procedure while you set up the plotter for plotting. The switch settings on the plotter are given in Figure 27. You need to change the switch settings when the plotter is turned off since they only have an affect at power-up. You also need to be sure the cable connecting the ink plotter with the SAV283 workstation is connected.

Paper is loaded by aligning its left edge with the paper guides on the left side of the plotter. Then you need to press the "Chart Load" key on the plotter. After the

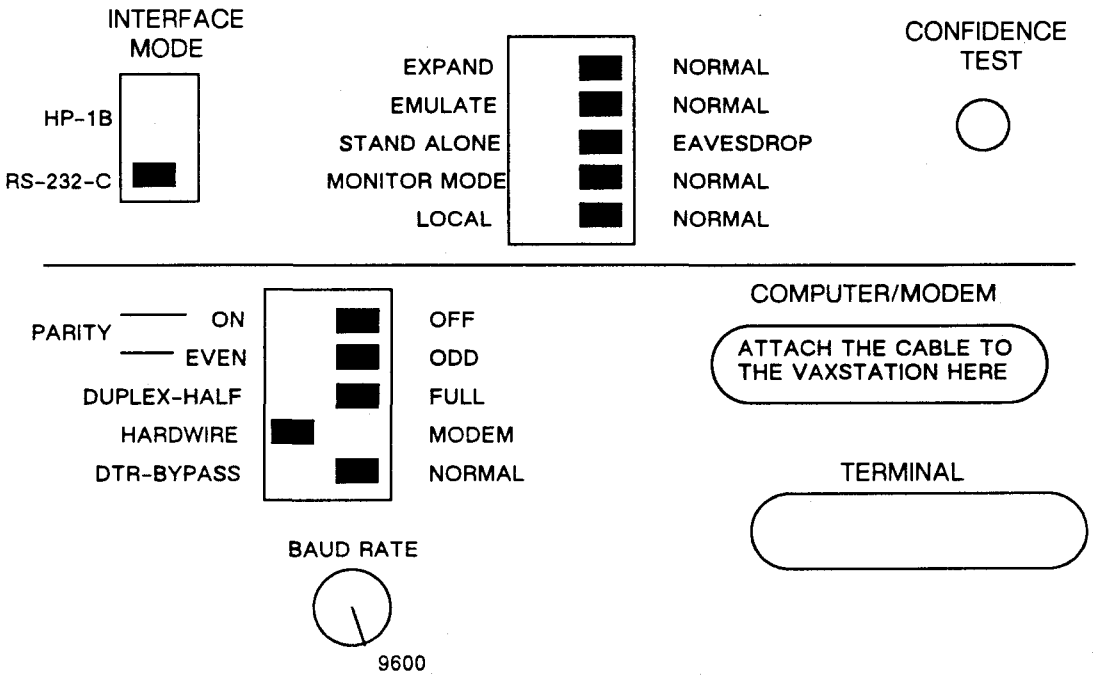

Figure 27. Hewlett-Packard 7585B Switch Settings

plotter finishes loading the paper, you need to press the "Remote" key to place it "on-line" to the VAXstation. The plotter is now ready for plotting, and you can press the "return" key to start plotting.

The pen numbers in ANVIL-5000 correspond to those used by the Hewlett-Packard plotter. Different pen numbers can be assigned to different entities in ANVIL-5000, but it is easiest to assign them according to level number. By using different pen numbers, you can vary the color and line width used for different parts of the drawing.

After the drawing is finished, you need to press the "View" key on the plotter to take it "off-line", and then press the "chart unload" key to unload the paper.

8.2. GRAPPLE Programs

ANVIL-5000 can be programmed to do several steps at once using a language called "GRAPPLE". Some programs have been developed by Department 2850 for use by drafting. We got a copy of these programs and installed them on the Department 9140 workstations so you can use them inside ANVIL-5000. These programs have not been fully tested or documented, so you will have to experiment with them

to see if they will do what you want. The following list gives a brief description of each program:

ANGLE	- Draws angle iron sections
ARC-CL	- Draws arc and circle centerlines
ARW	- Draws a line and arrow parallel to a base line
BEAMS	- Draws I-beams of various sizes
BEARING	- Draws a profile view of a bearing
BISECT	- Draws a perpendicular bisector of points, line, arc or spline
BKT	- Draws a text collection bracket
BOLT	- Constructs hex head bolts from 0.25 to 2.00 diameter
BOLTOP	- Draws top view of standard hex bolt
BOLTSX	- Draws side view of standard hex bolt
BOX	- Draws drafting parallelogram symbol
CBORE	- Draws side view of counterbored holes
CHANL	- Draws channel sections
CHANLS	- Draws standard channel sizes
CLCIR	- Draws circle centerlines
CONE	- Draws 3-D drawing of cones
COORDXYD	- Generates a point table downwards
COORDXYU	- Generates a point table upwards
CPSCRT	- Draws top view of standard socket head cap screws
CPSCRW	- Draws side view of standard socket head cap screws
CSK	- Draws side view of countersunk holes
EL45	- Draws long radius 45 deg pipe elbows
FASTENER	- Draws a variety of nuts and screws
FLWSHR	- Draws standard size washers
GYROU	- Draws Gyrolok brand tube fitting union
HEX	- Draws hex nuts
HEX2	- Same as HEX but lets you input the level
HEXS	- Draws regular and heavy hex slotted nuts
HG1A	- Draws hex socket head cap screws
HG7A	- Draws socket head shoulder screws
HOLES	- Draws tapped, slotted, counterbored and countersunk holes

HOLETBL	- Generates a hole table for coordinates, points & holes
HOLEXYD	- Generates a hole table downward
HOLEXYU	- Generates a hole table upward
IBEAM	- Draws I-beam sections
JAM	- Draws jam nuts
LEVEL	- Sets the level for lines, cross-hatching, dimensions, etc.
LKWSHR	- Draws lock washers
MITER	- Constructs 3-D pipe with a mitered end
NFLWSH	- Draws flat washers
NIBCIR	- Makes a circular array of points
NODE	- Draws open or filled electrical terminal symbols
NUT	- Draws nuts per MS 51967
PAPER	- Generates paper sizes with optional border
PATTERN_LOCATE	- Locates patterns and obtains information
PATTERN_RETRIEVE	- Retrieves pattern
POINTXYD	- Generates a hole table downward
POINTXYU	- Generates a hole table upward
PPTHRD	- Draws pipe threaded sections
RECTR	- Used as aid to draw rectangle to round transition piece
SCREL45	- Draws screwed 45 deg elbows
SCRTEE	- Draws screwed tee fittings
SCRUNYN	- Draws screwed pipe unions
SCURVE	- Draws shaft break curves
SHCS	- Draws socket head cap screws
SHLD	- Draws shield lines for electrical diagrams
SHSS	- Draws socket head shoulder screws
SLOT	- Draws drafting race track symbol and optional leader
SLOT2	- Similar to SLOT but must have a declared point
SRWL90	- Draws screwed 90 deg elbows
STUBE	- Draws structural square tube sections
STUD	- Draws stud bolts
TABLE	- Draws a table with columns and rows
TAP	- Draws side view of tapped holes
TAP2	- Draws end view of tapped holes
TAPEND	- Draws end view of tapped holes

TAPHLESM	- Draws side view of tapped holes
TAPHLEUNM	- Draws side view of tapped holes
TAPSIDE	- Draws side view of tapped holes
TEE	- Draws weld prep pipe tee fittings
TERM	- Draws open circle electrical terminal for wiring diagrams
THRDOLET	- Draws Bonney Forge Threadolet fittings
TILDE	- Draws tilde symbol between any two lines
WELD	- Draws welding symbols with multiple leaders
WELDOLET	- Draws Bonney Forge Weldolet fittings
WFLGE	- Draws structural wide flange sections
YBRNCH	- Contructs 3-D representation of Y-branch

These programs are executed with the menu selection 5.2.2. ANVIL-5000 has been set up so that you only need to type the GRAPPLE program name and it will locate it correctly.

If you write your own GRAPPLE programs, you need to fully-specify the filename by including the disk and directory name. In ANVIL-5000 the directory name must be enclosed with greater-than and less-than signs rather than brackets.

9. Other CAE Software

Although ANVIL-5000 is the most commonly used software on the Department 9140 workstations, many other computer programs are available. This section gives brief descriptions and references for other programs which are available on all workstations. To start any of these programs, you just need to enter the program name.

AMEER

This program was developed by the aerodynamics department at Sandia for predicting the trajectory flight path of an object, and it is documented in Reference 14. AMEER provides a full six degree-of-freedom dynamic simulation of a flight vehicle, and it can also be used to generate point-mass trajectories. Aerodynamic, propulsion and gravity forces can be simulated along with atmospheric properites.

AMEER is only available on the Cray computers, so the VAXstation is used only for pre- and post-processing of the data. It requires input data defining the forces, moments and trajectory initial conditions, and it produces an output file with the trajectory data.

The input file can be created on the VAXstation with one of the text editors. The AMEER procedure installed on the VAXstation sends this file and some job control information to the Cray for execution. After the Cray runs AMEER it sends the output file back to your VAXstation. Then you can display or print the output file. A program is also available from the author for converting the AMEER block printout into an EGS data base file for plotting.

ATMOS

The model atmosphere program can be used to display or print atmosphere properties as a function of altitude or it can compute the altitude corresponding to a given atmospheric property. The properities can also be written to an EGS data base file for plotting. This program uses the same model atmospheres used by the trajectory programs PMAST, TSAP and AMEER. A brief report on ATMOS is available from the author and you can enter a "?" after any prompt for help.

CALC

This program performs the same function as a calculator. You enter a mathematical expression in a form similar to FORTRAN, and it evaluates it. For example, you could enter

```
> 1.0 + SQRT(1.0 + 0.2*2.4**2)/SIN(45.0/57.2958)
```

and it would compute the result. The program can only evaluate expressions with numbers, it cannot solve for variables. No documentation exists for this program, but you can enter a "?" after any prompt in the program for help.

CALENDER

This program creates a large window with a calender on your screen. You can display any month by clicking the mouse on command buttons. If you click the mouse button on a day of the month, the program opens another window that lets you enter some notes. Any words in the notes that begin with the back slash character are displayed in the calender window as reminders. You can also print the notes for each day and print the calender. No documentation exists for this program.

EGS

This program is the primary graphics software used by the CAE analysis programs. Its purpose is to manage and plot sets of engineering analysis data for use in reports and presentations. It is capable of producing nearly any type of x-y plot from a set of tabulated data. After the plot curves have been retrieved from the tabulated data, EGS can be used to interactively modify the appearance of the plot for use in a report or presentation. Modifications appear on the workstation exactly as they appear on the final hardcopy avoiding costly iterations.

EGS accepts two types of input files: data base files and plot display files. Data base files contain tabulated engineering analysis data (columns of numbers). They are used when you do not know beforehand what you want to plot. When you use data base file, EGS prompts you for the x and y-axis variable names and other information defining the plots you want.

Plot display files only contain information about specific plots; for example, the x and y-axis and the plot curves. Plot display files are used when you know what data you want to plot. They are also used to store plots generated previously.

Hardcopy plots can be made on the black and white laser printers, the Calcomp color printer, and the Dichmed color printer at the central site. Plots made with EGS can also be transferred to the Interleaf (IWS) technical publishing software to be used as figures. EGS has the capability of reading ANVIL-5000 plot files, so you can use drawings from ANVIL-5000 in viewgraphs made with EGS.

EGS is documented in Reference 15.

IDEAS

IDEAS is a mechanical design and analysis program purchased from SDRC. It is a very large and complex program that can be used for solid modeling, mass properties, drafting, and finite-element analysis. Department 9140 has two IDEAS software licenses, so although it can be accessed from any workstation, only two users can access it at the same time.

If you want to use IDEAS, you should probably take the classes offered by SDRC. These are expensive, but IDEAS is complicated enough that it is difficult to learn on your own. Two sets of manuals, Reference 16, are available in the department, and telephone consultation is also available.

Hardcopy from IDEAS can be made on the laser printers with the PLOTI procedure and on the Dichomed color printer at the central site with the PLOTVG procedure. IDEAS can transfer drawings to the Interleaf (IWS) technical publishing software directly. It can also transfer data (both to and from) ANVIL-5000 with IGES files, although this data transfer is not reliable.

IDEASPIC

IDEASPIC is used in combination with IDEAS and PLOTVG to produce color viewgraphs on the Dichomed film recorder at the central computing site in Building 880. IDEASPIC submits a batch job that creates a picture file from an IDEAS model file. The default resolution of the picture file is 2000 x 2000 pixels, which corresponds to the Dichomed. Before IDEASPIC is run, you must use IDEAS to create a model file and be sure the lighting, shading, view and other parameters are correct.

IDEASPIC prompts you for an IDEAS model filename with no extension, a program filename, a batch queue name, and a time that you want to run the job. The program file contains IDEAS commands used to generate the picture file. You can make your own program file, or you can use the default. In most cases the default file is sufficient. The default batch queue is SYS$BATCH, and the default time is the current time. Usually you only have to enter the IDEAS model filename and then accept the default values.

If you use the default program file, the resulting picture file is named BATCH.PIC. You must run IDEASPIC from the same directory that the IDEAS model file is in. If you need help with this procedure, you should see Mark Judy from Titan Corporation.

IWS (Interleaf)

Interleaf or IWS is a technical publishing software package that can be used as a simple word processor or for producing complete reports. It is a "what you see is what you get" type of word processor, which means that what you see on the screen is exactly like what is printed. Interleaf includes simple drawing commands for making figures and tables, and it has the ability to typeset equations. It also can automatically number figures, tables, and sections, and you can reference these numbers in the text. If the numbers change, they will be changed everywhere they are referenced.

ANVIL-5000, EGS and IDEAS can all produce Interleaf document files containing drawings or figures. These files can then be cut and pasted into reports inside Interleaf.

Interleaf requires a special printer, and only one is currently available in Department 9140. When you request Interleaf to print a document, it is automatically sent over the network to the correct printer.

Two sets of Interleaf manuals, Reference 11, are available in the department. Although Interleaf is complicated and has many features, it is not that difficult to use for most tasks. The tutorial manual is a good place to start learning about the program.

MISDAT

MISDAT is the name used on the CAE workstations for the USAF Missile DATCOM aerodynamic prediction program documented in Reference 17. This program requires an input file defining the missile geometry and flight conditions, and it produces an output file with the aerodynamic and stability and control characteristics of the missile. It runs quickly on the VAXstations, but its accuracy is only suitable for conceptual design studies.

NSWC

The NSWC Aeropredict program is similar in function to the Missile DATCOM program, but it is an older program developed during the 1970's. It is documented in Reference 18. Like Missile DATCOM it requires an input file with the missile geometry and flight conditions; however, the input file is difficult to set up correctly. A pre-processor program is available, called PRENSWC, to help you create an input file. The NSWC program creates an output file with the aerodynamic and

stability and control characteristics of the missile. Its uses methods similar to Missile DATCOM, so it runs quickly, but it only accurate enough for conceptual studies.

PLOTI

This procedure prints an IDEAS picture file on a QMS or Talaris laser printer. You enter the picture filename, and you select the printer from prompts. PLOTI only prints the lines and text from IDEAS; it does not print the shaded images.

PLOTVG

The PLOTVG procedure converts an IDEAS picture file into a Dichomed plot file, and it is used to create color viewgraphs or slides. The Dichomed file can be send to the central site using the ONODE utility.

You must provide the IDEAS picture filename, the output Dichomed filename, and the type of output (DICO810 for 8 x 10 viewgraphs or DICO35 for 35 mm slides). You can also provide an optional file containing some title information.

The optional file turns on and off the IDEAS header information, and it allows you to enter your own title. The first line of the file contains a "Y" if you want the IDEAS header information or an "N" if you do not. If you enter an "N", then you can enter up to 10 additional lines of text with up to 105 characters per line. The text on each line is normally centered. If you do not want it centered, then you need to place the text inside quotes.

PMAST

PMAST is a point-mass trajectory analysis program developed at Sandia and documented in Reference 19. Its primary feature is that it is easy to use compared with other trajectory programs. It requires two input files: one defining the aerodynamic and propulsive forces, and one defining the trajectory. Aerodynamic and propulsive forces can be functions of any of the state variables. A simple and flexible method is provided for defining the trajectory.

PMAST always creates an output file with the resulting trajectory, and it can create plot files. It can also create an EGS data base file or an EGS plot display file or both. PMAST can be run on the Cray or on the VAXstations. Most problems run quickly enought that they can be run on the VAXstations. If you need to run a point mass trajectory, you should also look at TSAP since it is a newer program derived from PMAST.

PURMAGIC

This program is a pre- and post-processor to several different aerodynamic prediction programs. In Department 9140, we use it to access Sandiac and HIBLARG, which are two programs developed by the Aerodynamic department at Sandia. Both of these programs use computational fluid mechanics methods, and they give reasonable accurate results. These programs are documented in References 20 through 22.

The PURMAGIC program runs on the VAXstation, prompting you for geometry and flight conditions. Then it submits jobs to run Sandiac or HIBLARG on the Cray. Output files are returned to the VAXstation via the Integrated File Storage (IFS). PURMAGIC can be used to retrieve these files and perform some post-processing. Plots of the predicted flow field can also be generated with PURMAGIC.

ROCKET

ROCKET is an interactive program that predicts solid rocket motor performance for conceptual design studies, and it is documented in Reference 23. Given a minimum amount of information, such as the motor length, diameter and propellant characteristics, it predicts the average thrust, mass flow, burn time, motor weight and total impulse. It uses simple methods and runs quickly.

Several sets of input data have been calibrated to match existing motors and saved in a data base accessible to the user. This data can serve as a starting point for designing new motors.

Results generated with ROCKET can be printed and plotted. Thrust versus time curves can also be generated in a format for PMAST and TSAP.

SHABS

This program is a Sandia version of the USAF Hypersonic Arbitrary-Body Program (HABP) developed by McDonnel Douglas. This program predicts aerodynamic and stability and control characteristics of any vehicle geometry at hypersonic speeds. Although it runs quickly on the VAXstation, its accuracy is only useful for conceptual studies. SHABS is most useful for unusual vehicle geometry or flight conditions.

The methods used by SHABS are the same as those in HABP, which are documented in Reference 24. The program input and output files are different for

SHABS though, and the format has not been documented yet. Example input files are available from the author.

TSAP

TSAP is another point-mass trajectory analysis program developed at Sandia. It is based on the PMAST program, and it uses almost exactly the same input files. It has many of the same features as PMAST including the capability to generate EGS data base files and plot display files. The primary new feature of TSAP is the capability to perform parameter optimization on the trajectory. TSAP is documented in Reference 25.

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