CADMADE - An Approach Towards a Device-Independent Standard for CAD/CAM Software Development

by

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(ABSTRACT)

Every year thousands of specialized CAD/CAM applications programs are developed to meet the needs of industry, education and research. The international 3-D graphics standard, PHIGS, has proven to be very useful in the creation of custom CAD/CAM software. Although PHIGS+ promises to deliver some geometric modeling procedures, not nearly enough is being done to support the writing of CAD/CAM software. CAD/CAM applications programmers should have available a standardized high level applications programming environment which supports the creation of device-independent and portable design and manufacturing software.

In this dissertation, one approach towards the establishment of a CAD/CAM programming standard has been presented. This programming environment is called CADMADE - Computer-Aided Design and Manufacturing Applications Development Environment. CADMADE includes not only graphics programming support, but also high level procedures to support the creation of geometric modeling, mechanical design, manufacturing, expert systems and user interface software. The requirements of CADMADE have been created. CADMADE consists of five environments: the User Interface Environment (UIE), the Design and Modeling Environment (DME), the Virtual Manufacturing Environment (VME), the Expert Consultation Environment

(ECE) and the PHIGS+ Environment. The User Interface Environment has been designed in great detail. A prototype of the User Interface Environment has been created using PHIGS. Examples of applications programs which use the prototype User Interface Environment are presented. The Design and Modeling Environment has also been designed. A new set of logical input/output devices has been created for the Design and Modeling Environment. The requirements of the Expert Consultation Environment and some new concepts in expert system consultation are discussed.

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GLOSSARY

The following is a list of acronyms used in this dissertation.

ACSYNT	AirCraft SYNThesis
AI	Artificial Intelligence
ANSI	American National Standards Institute
CAD	Computer-Aided Design
CADMADE	Computer-Aided Design and Manufacturing Applications Development Environment
CAM	Computer-Aided Manufacturing
DME	Design and Modeling Environment

ECE	Expert Consultation Environment
ET	Expert Technician
GKS	Graphical Kernel System
KBS	Knowledge-Based System
ISO	International Standards Organization
PHIGS	Programmer's Hierarchical Interactive Graphics System
UIE	User Interface Environment
UIMS	User Interface Management System
VME	Virtual Manufacturing Environment

1. Introduction

In recent years, methods of design have been greatly altered by computer-aided design and manufacturing (CAD/CAM). Sale of CAD/CAM hardware and software is a multi-billion dollar industry. However, as rapidly as software is being developed, we have only begun to scratch the surface on the integration of design software with CAD/CAM systems.

The CAD portion of CAD/CAM systems usually includes design-drafting, 3-D wireframe modeling, surface modeling, solid modeling, preprocessing for finite element methods or links to finite element solvers, geometric analyses and assorted specialized analysis techniques. Although a lot of money and time is being spent on integrating CAD with CAM, very little effort is being concentrated on integrating mechanical design with CAD. Integration of mechanical design with CAD systems is as important an issue as integration of CAD and CAM. It will not be solved by the development of databases and database standards alone.

The process of designing a part or assembly is very complex and often requires some decision making by an experienced engineer. Until a few years back, it was very difficult to program a computer to make such decisions based on subjective criteria. With the help of the recent advances made in the fields of Artificial Intelligence (AI) and Knowledge-Based Systems (KBS), it is now possible to program a set of rules into a computer and allow the computer to make decisions based on those rules. Moreover, the knowledge and experience of an engineer can also be transformed into facts and rules which the computer can use to make intelligent decisions. The time is thus ripe for CAD researchers to devote more time and effort to the integration of CAD systems with mechanical design processes.

Most custom CAD applications programs rely on computer graphics support systems for an efficient and effective use of CAD/CAM techniques. The emergence of the Graphical Kernel System (GKS) as the international 2-D graphics programming standard was a landmark event in the history of computer graphics. The concept of device-independent graphics and standard graphics routines was standardized for the first time. In 1988, Programmer's Hierarchical Interactive Graphics System (PHIGS) was accepted as the American National Standards Institute (ANSI) standard for 3-D graphics programming. PHIGS has greatly enhanced the capability of custom CAD/CAM systems by providing full 3-D functionality along with device independence.

Although custom CAD/CAM systems have benefitted greatly from the standardization of graphics, there is still not enough support for the easy creation of custom CAD software and for the integration of CAD with mechanical design.

In this dissertation, an approach towards the creation of a standardized CAD/CAM applications programming environment is presented. The overall system designed, called

CADMADE, is described. The elements of the programming environment directly related to computer-aided design are discussed in detail. A prototype of some portions of the device-independent environment is described.

2. Literature Review

For the purpose of the literature review, recent advances made in the field of computer-aided design and computer graphics applications in CAD can be broadly grouped into four categories:

1. User Interface Systems
2. Geometric Modeling and Mechanical Design in CAD
3. Expert Systems in CAD
4. Standards

2.1 User Interface Systems

A good user interface is essential for the efficient use of a CAD/CAM system by a designer. For example, a good user interface does not compel the user to follow a sequence of predetermined steps. Sata and Warman (1981) have compiled a number of

good publications addressing the topic of man-machine communication in CAD/CAM. A User Interface Management System (UIMS) assists applications programmers to provide good quality interfaces for their programs. Janni and Italiano (1986) have presented a general purpose user interface management system based on user driven menu handling and a hierarchical organization of graphics data structure. Myers and Buxton (1986) have designed a system that automatically creates the code for user interfaces while the designer demonstrates to the system how the interface should look and work. Gallop (1987) has discussed the importance of standards and standardization in developing user interface management systems. Kilgour (1987) has outlined the development of the user interface management system (UIMS) as a concept and has discussed some issues related to the design and implementation of such systems. Haeberli (1988) has discussed a user interface for dynamically building and modifying graphics applications.

Koivunen and Mantyla (1988) have described a user interface management system intended for applications in mechanical CAD. In this system, a three-layered internal architecture is used which clearly separates presentation, dialog control and applications processing. Olsen and Dance (1988) have described a macro facility that allows end users to extend interactive graphical applications as a part of a user interface management system. Both these systems were device dependent and were designed to be used on specific computer systems.

Wampler (1988) has described the design and implementation of a hierarchical menu system (based on PHIGS) as part of a user interface for an aircraft design code. Blevins (1988) has described a modular graphics menu manager which uses PHIGS. This menu manager is system dependent and creates command files and PHIGS archive files which

are used for the menu interface for applications programs. Although this menu manager uses PHIGS as the graphics support system, it uses computer system dependent command sequences to process menu selections and execute appropriate portions of the applications program.

Some researchers have tried to improve man-machine interaction by designing new input devices. Kankaanpaa (1986) has described an experimental display system that allows the use of a pen-like device to draw directly on the display surface. Thatch and Myklebust (1988) have described a six-degree-of-freedom input system using PHIGS for rotation and translation of solid objects. Chen, et al. (1988) have described the design and evaluation of four virtual controllers for use in rotating 3-D objects using a mouse. They have studied user performance during simple and complex rotation tasks.

Ware and Jessome (1988) have described the configuration of a six-dimensional mouse and the interfacing of the mouse with an Iris workstation. The six-dimensional mouse allows an object to be translated in X, Y and Z coordinates and rotated about the three axes. Chan and Hoeltzel (1988) have described a new 3-D input system aimed at alleviating the labor-intensive task involved in specifying data input for the description of 3-D objects. This input system is based on the use of an intelligent user interface and a three-dimensional digitizer for the direct input of spatial coordinates.

Recently a number of window managers have emerged to the forefront of User Interface Management Systems (UIMS). Myers (1988) has presented a taxonomy of window manager user interfaces. He has evaluated the similarities and differences of various window managers and has discussed some of the issues that need to be addressed by designers of future window manager user interfaces. One of the window managers discussed in the above-mentioned publication is the X window system (Scheifler and

Gettys, 1986). The X window system has achieved fairly widespread popularity recently, particularly in the UNIX community.

2.2 Geometric Modeling and Mechanical Design in CAD

Geometric modeling provides an analytical, mathematical and abstract description of objects. Geometric modeling is an important part of CAD and CAM. Until recently, most CAD/CAM systems relied primarily on curves and/or surfaces for describing models. With the advent of fast CAD/CAM workstations, solid modeling has become the most popular geometric modeling method for CAD/CAM applications. Researchers are still trying to develop better methods of using solid modeling in CAD/CAM systems. For example, Saeed, et al. (1988) have discussed a class of operations called "offsetting" for solid models. However, recent interest in the field of integration of CAD and CAM has led to the development of "feature-based" modeling. A feature is defined as an entity which captures a characteristic of a local area of a part (e.g., hole, corner, shaft, etc.). Chen (1988) has discussed the concept of part feature and the possibility of using part feature to integrate CAD and CAM systems.

Shah and Rogers (1988) have briefly described the problems in applying solid modelers to engineering applications. They have emphasized the fact that solid modelers do not provide an environment conducive to creativity in design. They have described an expert system shell for form feature modeling. The expert system shell can also extract feature information from design data.

Woodwark (1988) has discussed the possible use of the set-theoretic (constructive solid geometry) solid model for feature recognition. Some of the problems of applying a feature recognition process to shape models have also been outlined in the same paper. The development of a graph-based method for the recognition of machined features from 3-D boundary representation solids is described by Joshi and Chang (1988). A model for topological and geometric reasoning about mechanical designs is described by Duffey and Dixon (1988). A computer program which uses the 2-D domain of extrusion cross-section as a case study is demonstrated as a model.

Deitze (1989) has discussed the importance of parametric programming and feature-based design. Gossard, et al. (1988) have addressed the topics of dimensions, tolerances and features in solid models. Luby, et al. (1986), Dixon and Simmons (1986), Drake and Sela (1989) and others have described research and applications in the area of feature-based modeling. Gandhi and Myklebust (1989) have discussed a natural language approach to feature-based modeling for the creation of geometric models of features.

Although the research in feature-based design was initiated by the need for a better and easier method for the creation of models of shapes and forms used frequently in mechanical design, very little research is being concentrated on integrating mechanical design with CAD. Serrano and Gossard (1986) described interactive software which integrates mathematical models (consisting of algebraic equations, etc.) with geometry models to aid in the preliminary (or conceptual) design of mechanical components. Cagan and Agogino (1987) developed a design methodology to perform innovative design of mechanical structures from first principle knowledge.

Various studies in the field of variational geometry have been presented by Lin, Gossard and Light (1981), Light and Gossard (1982), and Aldefeld (1988). "Variational Geometry" uses a single representation to describe the entire family of geometries that share a generic shape (Light and Gossard, 1983).

Gandhi and Myklebust (1986) have described methods for designing cams from design through manufacture using CADAM and GKS. Irwin and Myklebust (1986) have discussed a similar system for designing gears.

Every CAD/CAM applications program has to store and retrieve large amounts of data. This has led to research in the field of databases and data structures for CAD/CAM. Roy and Liu (1988) have proposed a semantic association model to organize explicit interface information between the major part components in an assembly environment.

Arora and Mukhopadhyay (1988) have described a generalized relational model to handle large matrices and tables that are encountered in numerous CAD applictions. A database management system based on the model has also been described. Kaufman (1988) has discussed the recent explosion of interest in computerized material property databases and intelligent knowledge systems for flexible manufacturing processes. Colton (1988) has discussed the design and implementation of a relational materials property database.

Howard and Howard (1988) have described a conceptual approach for multimodal engineering database interface combining multipurpose graphics, an engineering query language and other interface methodologies in an engineering workstation environment.

2.3 Expert Systems in CAD

In recent years some leading researchers in the field of CAD/CAM have been concentrating on developing means of utilizing Artificial Intelligence (AI) to improve the techniques used in CAD/CAM. The following is a brief literature review of the various applications of AI and expert systems in CAD/CAM and mechanical computer-aided engineering (MCAE).

Hatvany (1984) presented a prediction of the future of CAD and identified knowledge-based techniques as the most important tool for CAD for the future. Calkins (1985) created an interactive graphics environment in conjunction with expert systems to create and display a three-dimensional representation of a sculptured surface object from three orthographic views. Davidson (1985) has drawn up a list of requirements for an expert system based CAD decision-making tool. Vaghul, et al. (1985) have described an expert system which evaluates designs of a sub-class of injection molded parts on simple manufacturability criteria. Etesami and Zarefar (1985) have discussed the design of a network of expert systems to emulate a design team. Kinoglu, et al. (1986) have described an expert system based implementation of a constraint based approach to design. Jayaram and Myklebust (1989) investigated the automatic generation of interfaces between design applications programs and CAD systems, with the aid of an expert system.

Rosenman, et al. (1986) have demonstrated the use of rule-based expert system shells in elementary design decision making. Ohsuga (1983) has discussed a new method for

describing and manipulating engineering models. This method makes use of a knowledge base and inference techniques and allows both model structure and model attributes to be represented in a declarative form. Whitney and Bond (1987) integrated a CAD system, CADAM, with an AI system using VM/PROLOG to produce an intelligent CAD/CAM system. This system allows the user to interact through one screen to (i) work graphically in the conventional CADAM system, (ii) write application programs in PROLOG, or a mixture of PROLOG and FORTRAN, (iii) interact with the applications program, set goals and monitor results in PROLOG and (iv) produce modified drawings in PROLOG and display them in CADAM.

Some researchers have tried to develop new computer languages to improve the current techniques used in CAD. A "Function-Description" language was developed by Lai (1987) and Lai and Wilson (1987) to describe functional relationships between elements in a mechanical design. This system applies a series of design rules to the design and generates a set of recommendations for improving the design. Takase and Nakajima (1984) developed a "Feature-Descriptor" language for describing and modifying assembled machines.

Chan and Paulson (1987) have discussed the representation of the dual nature of constraints to maintain design consistency as a design evolves. The dual nature of the constraints arises from the fact that constraints need not only check designs but can also be used to derive design solutions that satisfy the constraints. Nguyen and Rieu (1987) have defined a new methodology for semantic constraints management and control. This methodology provides a unified basis for modeling the dynamic nature of complex

objects. Aldefeld (1988) has described a method for processing generic geometric models on the basis of symbol manipulation and forward inferencing.

Ishii, et al. (1988) have developed a general framework for knowledge based computer tools that promote simultaneous engineering in mechanical design. The underlying concept for these knowledge-based systems focuses on the compatibility between the design specification and the proposed design, evaluates the design based on the knowledge of experts and suggests improvements. Ramchandran, et al. (1988) have presented the development of knowledge-based aids for the design of mechanical systems.

Other fields of mechanical engineering where AI has been applied include kinematics, material selection, process planning, control system design, design of structural parts, design optimization, heat fin design, valve selection and problem diagnosis.

2.4 Standards

Activities in proposing and accepting graphics standards have been prevalent for more than a decade. The Graphical Kernel System (GKS) became an ISO standard for computer graphics programming in 1985 (Hopgood, et al., 1986). PHIGS was accepted as a standard for 3-D graphics by ISO in 1988.

Chin (1988, 1) has described the scope of graphics standardization efforts. Carson (1988) has discussed the future of ISO graphics standards. Chin (1988, 2) has described

the new procedures for graphics standardization adopted by ISO and its working groups. Meads and Puk (1988) have reported the initiation of new study groups by the computer graphics standards.

Besides graphics, standards are available for other areas associated with CAD/CAM. The Initial Graphics Exchange Specification (IGES) is a standard for transferring model data between dissimilar CAD/CAM systems. Pasquill (1988) has discussed the reasons for wishing to transfer product definition data between dissimilar CAD/CAM systems and the practical use of IGES to perform this task. Brandli and Mittelstaedt (1989) have examined the standards for exchange of solid model data between different CAD systems. This is very important with respect to the field of Computer Integrated Manufacturing (CIM). X windows is becoming a de facto standard for window management.

The creation of standards for graphics has proven to be very useful in the creation of CAD software. Thatch and Myklebust (1988) have decribed a graphics preprocessor that interactively assists in the definition of spatial mechanism problems. PHIGS was used for graphics support in this preprocessor. Wampler, Myklebust, Jayaram and Gelhausen (1988), have described the development of a PHIGS-based aircraft design system. This CAD software is designed to be used on the new generation of high-speed imaging workstations. The use of PHIGS assures graphics device independence and thus the software can be used on a number of different workstations which support PHIGS.

3. Problem Statement and Research Objectives

Although research in the field of CAD/CAM integration has been prevalent for several years, the integration of CAD and mechanical design has only recently been given the importance it really deserves. Leading researchers in this field have been concentrating mainly on using artificial intelligence (AI) techniques and expert systems in CAD/CAM and Mechanical Computer-Aided Engineering (MCAE). Few investigators have directly addressed the topic of bringing together mechanical design and geometric modeling.

Many commercially available CAD/CAM systems provide 3-D wireframe modeling and some also allow the creation of solid models. But these large commercial CAD systems are usually unable to treat complex mechanical design problems. These CAD systems mainly allow the creation of geometric models and the corresponding drafting of the design and details. This is due to the fact that each design problem requires its own set of design rules and has to be tailored to comply with the functional requirements of the design. Thus no predefined CAD system, however versatile and varied it may be, can hope to be able to address all the mechanical design needs of each industry and

organization. As a result, thousands of applications programs are developed each year to meet the needs of industry, research and education.

The process of developing custom CAD/CAM software involves a series of repetitive and time-consuming preliminary processes. After a decision has been reached regarding the geometric modeling techniques that need to be used for the particular application, thousands of lines of computer code are typically written to realize these geometric models (surfaces, curves, solids, etc.) and store the models in some form of a data structure. The design and implementation of the data structure to serve this purpose can also prove to be a time-consuming and expensive process.

Sometimes the original choice of the geometric modeling techniques may need to be changed. For example, bicubic Ferguson surface patches may have been initially chosen for generating the geometric models. Bicubic Ferguson surface patches are only useful for tangent continuity between surface patches. If at any stage, a decision is taken to incorporate a higher order continuity, large amounts of new computer code will have to be written to allow the CAD/CAM system to implement a different surface model. Thus, changing the geometric modeling techniques in a custom CAD/CAM system to satisfy changing needs and objectives can become very time-consuming and expensive.

Geometric modeling and computer graphics are very closely related in CAD/CAM systems. Once the geometric model has been defined, it is usually necessary to display the model on a graphics device. In this respect, PHIGS has already proven to be very useful in the creation of custom CAD software. Although PHIGS+ promises to deliver some geometric modeling procedures, not nearly enough is being done to support the writing of CAD/CAM software. The inclusion of B-splines and Bezier curves as primitives in the proposed PHIGS+ extensions is an indication of the intentions of

PHIGS+ to better support CAD/CAM and geometric modeling in the future. However, it has just begun to scratch the surface of the requirements of a standard in geometric modeling. Besides curve and surface generation, the state of the art in geometric modeling has rapidly changed in recent years to include solid modeling, feature based modeling, parametric modeling, etc. Thus, geometric modeling has grown so much that it might not be possible to include all the important features of geometric modeling in PHIGS+ and similar graphics standards. Thus, for any custom CAD/CAM software to be able to display geometric models, it will be necessary to develop code to use existing graphics standards and generate the display structures.

Another common requirement of interactive CAD/CAM systems is a good quality human interface. A number of User Interface Management Systems are available in the market. The literature review presented in the previous chapter shows a growing interest in User Interface Systems. However, almost all these systems are device-dependent and cannot be used to provide user interfaces for device-independent CAD/CAM systems. More device-independent support needs to be provided in the area of views and viewing and menu/Icon creation without going to the extremes of X windows or NeWS. Some CAD/CAM systems have been developed and are being developed based on the PHIGS/PHIGS+ standards while some others are being converted to use PHIGS for graphics support. Although these standards provide interaction and viewing facilities required to develop user interfaces, each one of these CAD/CAM systems has had to have designed and implemented methods of generating menus, managing menus, defining menu trees, defining and modifying views, managing prompts/messages, etc.

The growing importance of expert systems in CAD/CAM systems integrated with mechanical design is evident from the explosion of research and publications in this field.

The process of designing a part or assembly often requires decisions to be made based on subjective criteria. With the help of AI and Knowledge-Based Systems (KBS), it is now possible to incorporate such decision making systems with computer-aided engineering design systems. However, these expert-system-based CAD/CAM systems have to be developed from basic principles using AI languages (e.g., LISP, PROLOG, etc.). Commercially available expert system shells are system dependent and do not provide the applications programmer with the flexibility to easily and fully integrate the expert systems developed in these shells into custom CAD/CAM applications.

Thus, custom CAD/CAM applications programmers have to develop their own knowledge base, write their expert system from basic principles, set up the interaction between the user and the expert system, and set up the relationships between the CAD/CAM database and the expert system.

In recent years, new high-speed imaging workstations have started replacing the 'dumb' graphics devices which need to be supported by mainframe computers. These workstations are excellent platforms for CAD/CAM applications since they provide very good graphics display and high speed computing facilities. Most of these workstations have special hardware/software to speed up modeling and graphics operations. However, these workstations are constantly changing and improving. Once every few months, a new and better engineering workstation is being announced by the various manufacturers of these workstations. In order to be able to continuously take advantage of the improving technology, custom CAD/CAM software should be developed with the help of a device-independent and portable system. This would ensure upward compatibility and prevent the software from being tied down to one workstation vendor.

The future of CAD/CAM depends on the easy creation of specialized CAD/CAM applications software rather than on a group of very large, general purpose CAD/CAM systems as we have now. CAD/CAM applications programmers should have available a standardized high-level language in the form of a set of procedures and data structures which support the creation of device-independent, portable CAD/CAM software. We have been fortunate in having standards for programming languages since the early days of computing. Although they were much needed, graphics standards (e.g., GKS, PHIGS) were much slower in coming. PHIGS has already proven to be very useful in the creation of custom CAD software. A wide variety of modeling procedures, including both surface and solid models, and a general modeling data structure need to be provided in a standard programming environment.

The standardized CAD/CAM language should allow the applications programmer to make high level calls and easily develop custom CAD software with the appropriate user interface without having to spend time on the basic and repetitive processes of developing code to support menu systems, geometric modeling, expert systems, etc. Artificial intelligence support should be available to the CAD/CAM software engineer in a consistent, device-independent fashion. The same is true for a general database and database manager. This system should also include the device-independent 3-D international graphics standard PHIGS as one of its features to allow easy conversion of existing device-independent code to include the new features of the device-independent CAD/CAM programming language.

The objectives of this research are to:

1. Investigate the concept of a machine-independent and device-independent CAD standard.

2. Determine functional requirements of the proposed CAD standard.

3. Design the standard programming environment.

4. Define the relationships between the various elements in the CAD standard.

5. Develop a prototype of a portion of the programming standard.

4. ACSYNT/VPI - A Case Study

In order to examine the development of a typical custom CAD applications program, a case study was performed. The target of the case study was ACSYNT/VPI, a large computer-aided design system for conceptual design of aircraft. The development of this CAD system was closely studied and all the preliminary processes which were required for the development of the applications program were noted and are presented below. ACSYNT/VPI was chosen for the case study because of the author's involvement in the development of this CAD system for two years as a graduate student and because of its influence on the ideas presented in this dissertation.

4.1 ACSYNT/VPI

ACSYNT (AirCraft SYNThesis) is a well-known aircraft conceptual design code which was developed in the early 1970's at NASA's Ames Research Center to fulfill the need

to study the effects of advanced technology on future aircraft (Gregory, 1973). Currently the code is used at NASA-Ames for the analysis and design of Advanced Supersonic Short Take-Off and Vertical Landing (ASTOVL) aircraft (Gelhausen and Wilson, 1986). It is also used at a number of aerospace companies, notably Northrop and Boeing. In 1987, the CAD/CAM laboratory at VPI&SU began developing a computer aided design (CAD) interface for ACSYNT (Wampler, et al., 1988). This interface permits the execution and control of the design process via interactive graphics menus and, by visual inspection of data and aircraft model shaded images, allows rapid evaluation of design configurations. This CAD interface was coded entirely with the new 3-D graphics standard, PHIGS. The CAD interface along with ACSYNT is called ACSYNT/VPI and is designed to be used on the new generation of high speed workstations. The use of PHIGS and ANSI standard FORTRAN 77 renders ACSYNT/VPI machine-independent and graphics device independent.

The methods and procedures used in developing the user interface, geometric modeling techniques, data storage, etc. are discussed below.

4.2 ACSYNT/VPI User Interface

The user interface for ACSYNT/VPI was designed to be user friendly. It allocates screen space and uses color to lead the user's attention to what is most important. The menu layouts are kept simple and uncluttered to minimize hand and eye movement. The user

interface uses command menus, geometry views, message display areas and logical input devices. Figure 1 shows the ACSYNT/VPI screen layout.

4.2.1 Menu System

A menu-based design philosophy was used in ACSYNT/VPI in which all pickable items on the screen - menus as well as geometry - are treated as menus. A hierarchical command menu tree was designed to allow the user to select the various available functions and options. The command menu structure was implemented as a set of chained "menu modules", each representing one item in the menu structure. Menu modules either perform a function associated with a particular menu item, display a submenu, or both. Most menu modules consist of up to eight subroutines which are identical in function from one module to another. A second hierarchical menu tree called the "standard menu" is also available (shown on the bottom right of Fig. 1). The standard menu items are available to the user at all times, irrespective of the current command menu screen. A number of menu "utility" functions were designed to provide for the manipulation of menus. These utility routines amounted to approximately 1300 lines of documented FORTRAN code. They allow the creation and display of menus with a fixed "look and feel" designed specifically for ACSYNT/VPI. These menu utility functions, however, cannot display submenus automatically by traversing the menu tree. The applications programmer must take care of displaying submenus and removing them when the user wants to go back to the previous menu.

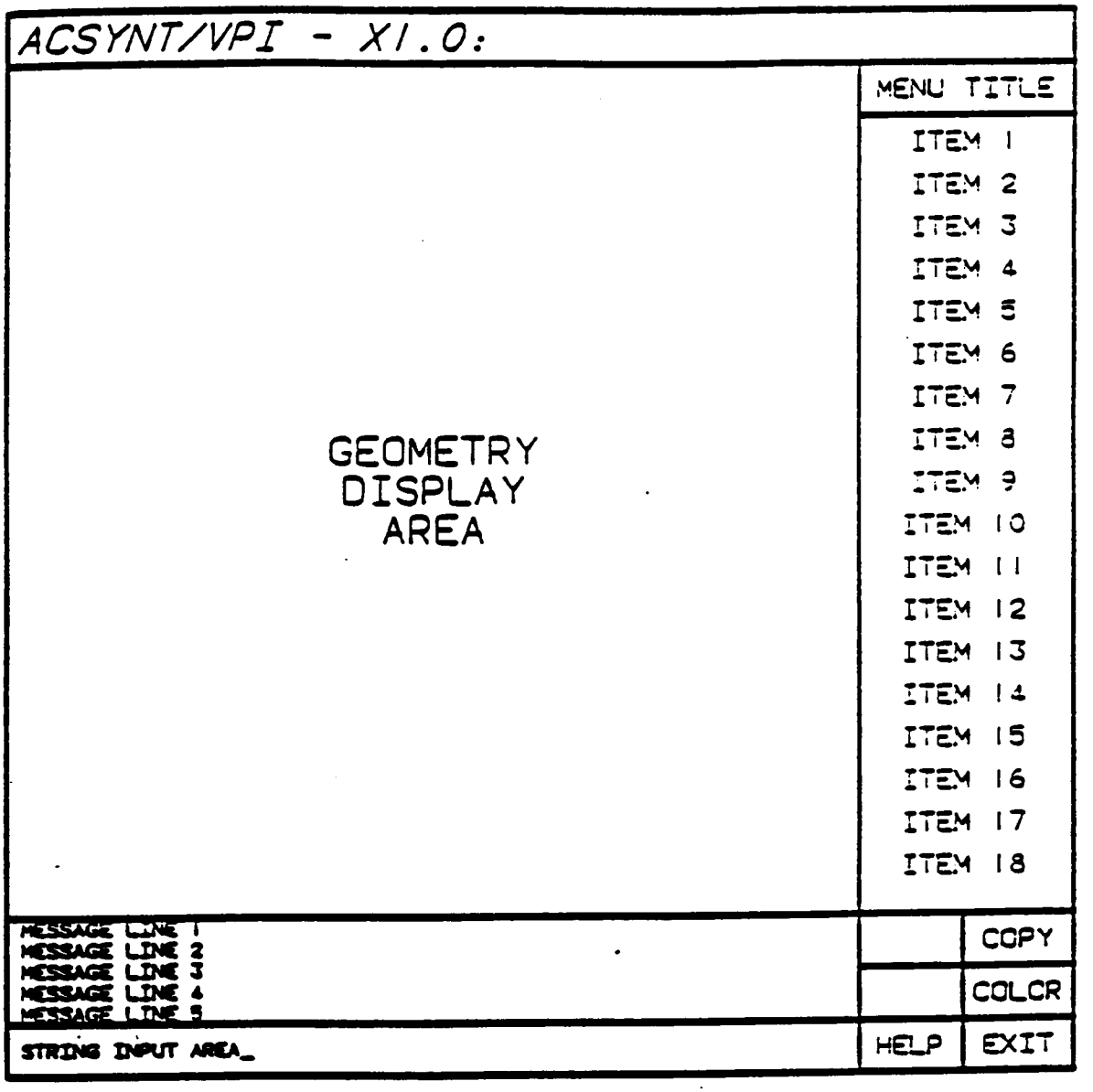


Figure 1. ACSYNT/VPI Screen Layout (Wampler, 1988)

4.2.2 Message Generation

A number of "message utility" routines were designed to allow the display of messages on the ACSYNT/VPI screen. The message generator permits five message lines to be displayed at any time with the previous message lines being scrolled up when a new message line is inserted in the message area.

4.2.3 Interactive Input Methods

All of the interactive user input of ACSYNT/VPI is accomplished through pick, valuator and string input devices. All these input devices operate in event mode. The pick device is used to select menu items from any one of the ACSYNT/VPI menu types.

The PHIGS string device allows character string data (e.g., filename, component name, etc.) to be entered using a keyboard. The string input area for ACSYNT/VPI is shown in Fig. 1. The string input is also used for numeric input. Utility routines had to be designed to parse a character string input and extract numerical values from the input text.

Many portions of ACSYNT/VPI allow the use of valuator input. For example, valuators are used for view transformations and for entering scalar values for numerical input. Seven valuator devices allow the user to enter the following view transformation values:

1. Rotation about the X axis.

2. Rotation about the Y axis.
3. Rotation about the Z axis.
4. Translation about the X axis
5. Translation about the Y axis
6. Translation about the Z axis
7. Uniform Scaling

Viewing procedures had to be developed to get the input from the valuators, compute the view transformation matrix and apply the matrix to the 3-D PHIGS viewport causing the geometry on the screen to rotate, translate or scale.

4.3 Geometric Modeling and the Geometry Data Structure

Geometric modeling is used within ACSYNT/VPI to mathematically describe the geometry of an ACSYNT aircraft, display an image of the aircraft and provide ACSYNT with information required to perform some aerodynamic calculations. ACSYNT/VPI is designed to maintain the following models of aircraft:

- ACSYNT/VPI component model
- ACSYNT/VPI component cross-section model
- ACSYNT/VPI component surface model

- ACSYNT/VPI PHIGS display model

The ACSYNT/VPI component model defines each aircraft component parametrically. A hierarchical structure is defined for the aircraft components; i.e., each component has a "parent" component and can have a number of "children" components. The ACSYNT/VPI component cross-section model defines each component as a set of parametric cross-sections. The cross-section model is used to generate the surface model of the aircraft. The surface model of a component is generated by "lofting" parametric surface patches over the cross-sections defining the component. HERMITE bicubic patches are used in ACSYNT/VPI and are defined by four corner points, tangent vectors and twist vectors. PHIGS display structures are created from surface models by interrogating the surface patches with lines. Figure 2 shows an example of an aircraft model displayed by ACSYNT/VPI.

In order to be able to achieve the geometric modeling procedures described above, a data structure was designed and implemented to store and retrieve all the data for the various models described above. Utility routines were written to generate geometry coefficient matrices for surfaces from the surface data structure, generate points on the surfaces for drawing the lines to be displayed and create the PHIGS structure hierarchy from the component hierarchy.

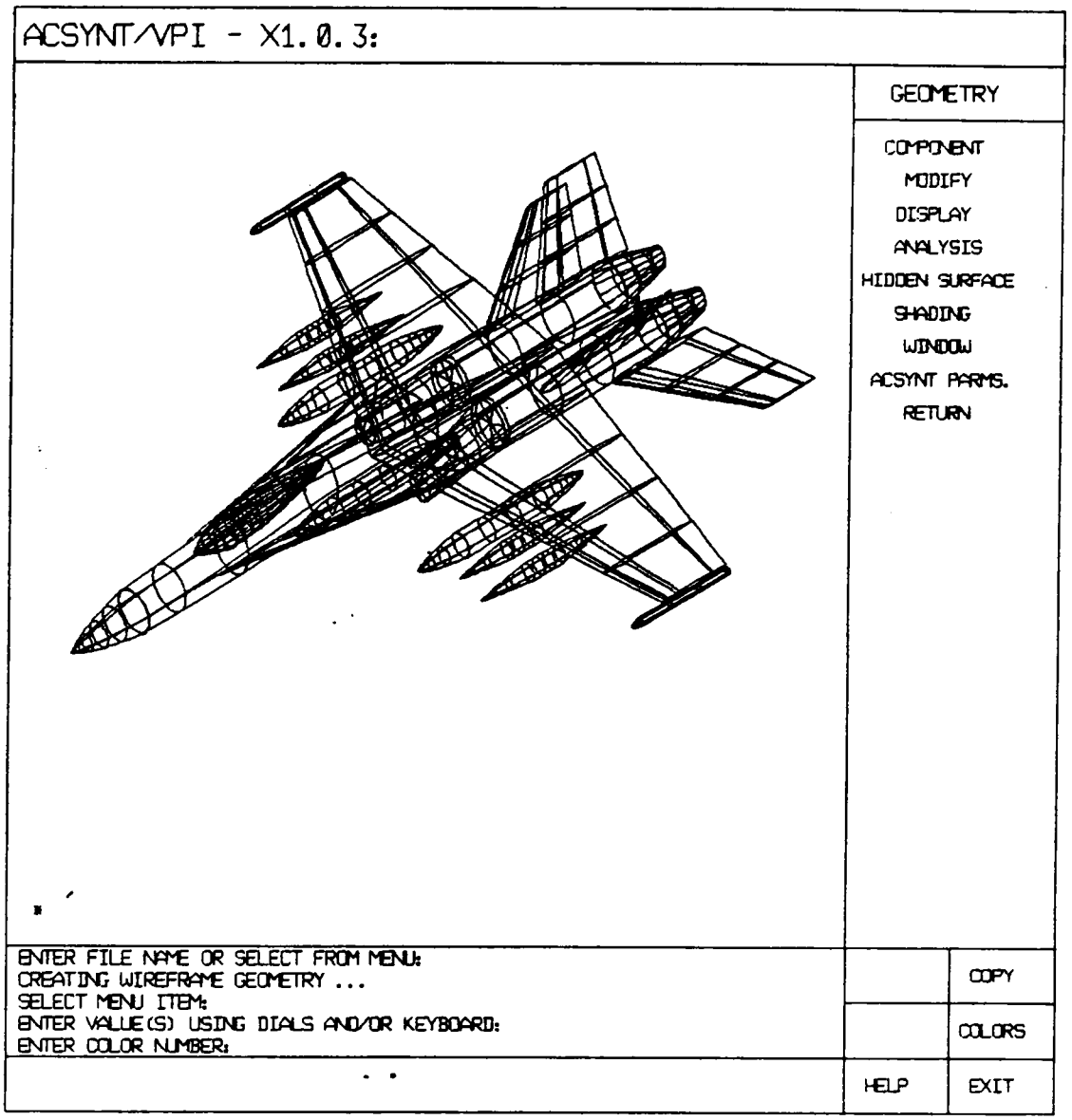


Figure 2. Aircraft Model Displayed by ACSYNT/VPI

4.4 Utility Functions

To assist in the development of the user interface and geometric modeling in ACSYNT/VPI, a number of utility procedures (other than the ones mentioned above) were designed and implemented. These include mathematical procedures (vector operations, matrix manipulations, etc.), character string manipulation procedures, viewing procedures, numerical input procedures and curve generation and interpolation functions.

Other utilities are being developed to calculate cross-sectional areas and to display templates for data input.

4.5 Conclusions

The preliminary process of developing all the utility procedures mentioned above took approximately one man-year. Many of these procedures are developed by most CAD/CAM applications programmers as a prelude to the development of the actual CAD/CAM system. If most of these utilities had been available as higher-level, device-independent functions, much of the effort spent in the preliminary stages of software development could have been saved. This case study demonstrates the need for a higher-level, device-independent CAD/CAM programming environment which goes beyond the scope of graphics standards and allows easy and fast creation of custom CAD/CAM software.

5. Overview of CADMADE

CADMADE stands for Computer-Aided Design and Manufacturing Applications Development Environment. CADMADE is designed to be a programming environment or an Applications Programming Interface (API) which facilitates the development of custom CAD/CAM software. The implementation should include a library of procedures, a series of specialized data structures and other CAD/CAM programming aids which can be accessed by the programmer developing a CAD/CAM system or a design and manufacturing applications program. It may be viewed as a high-level language for design and manufacturing applications programmers. CADMADE consists of software which minimizes the need for rewriting basic algorithms in interactive computer graphics, user interfaces, data management, geometric modeling, design analysis, manufacturing and artificial intelligence.

CADMADE is designed to manage the organization and display of data in a centralized collection of specialized data structures. This implies that the data are available to all workstations at the same time. CADMADE will relieve the applications programmer of tasks not previously considered or fully treated by graphics standards. PHIGS

manages the storage and display of and the interaction with 3-D graphics data by creating and managing a hierarchical data structure. In addition to graphics data, CADMADE should create and manage data pertaining to CAD/CAM applications.

Figure 3 shows an overview of this applications programming interface. CADMADE consists of five programming environments with corresponding data structures and two database managers, all of which can be accessed by the applications program. The environments are:

1. The User Interface Environment (UIE)--User Interface data structure
2. PHIGS + --PHIGS + data structure
3. The Design and Modeling Environment (DME)--CAD data structure and Product Information data structure
4. The Virtual Manufacturing Environment (VME)--CAM data structure and Product Information data structure
5. The Expert Consultation Environment (ECE)

The database managers are :

1. Universal Database Manager (UDM)--Universal Database
2. Knowledge Base Manager (KBM)--Knowledge Base

The design, manufacturing, user interface and graphics data can be stored in a series of pre-defined, interlinked centralized data structures. These data structures can be accessed by the applications program via the programming environments.

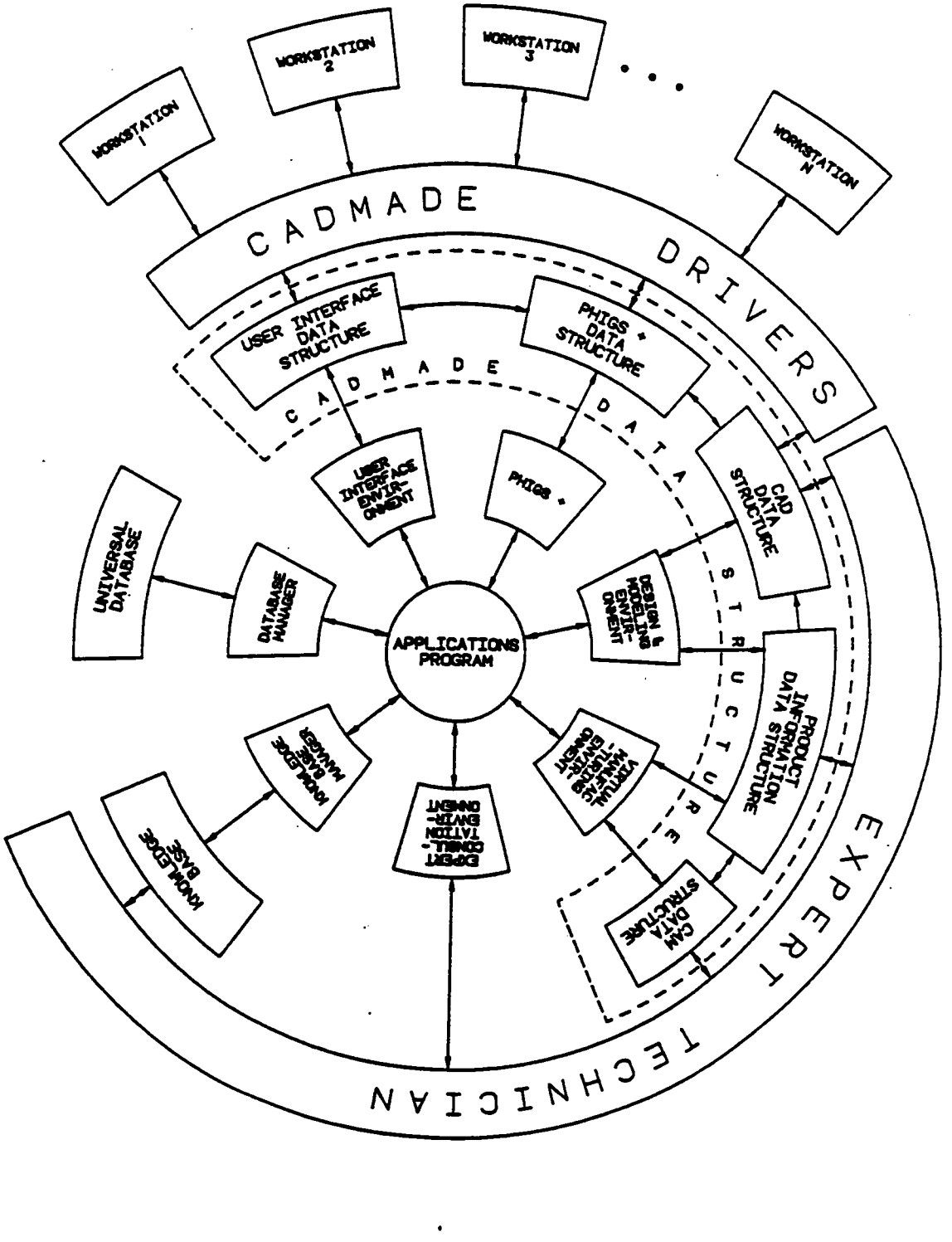


Figure 3. Overview of CADMADE

The User Interface Environment

The User Interface environment provides the applications programmer with procedures to implement an interactive graphical interface for the CAD/CAM applications program. The UIE should contain support for displaying menus and Icons, messages, prompts, etc. It should allow the applications programmer to easily define and modify some of the most commonly used views: front view, top view, etc. This viewing system should be simpler to use than the viewing procedures supported currently by PHIGS. The data generated by the applications program through UIE should be stored in the User Interface data structure. This data structure should be editable. The UIE and the User Interface data structures are discussed in greater detail in the next chapter.

The Design and Modeling Environment

The Design and Modeling Environment (DME) facilitates the development of geometric modeling, design and analysis software. The DME should include procedures for generating both surface models and solid models. These models can be analyzed using pre-existing (implementation independent) analysis software or application program defined analysis software. The design and modeling data generated through the DME should be organized in a hierarchical data structure, the CAD data structure. The DME should also allow the applications program to generate product information (e.g., bill of materials, surface finish, etc.) which can be stored in the Product Information data structure. The DME and the CAD data structure are discussed in detail in a later section.

The Virtual Manufacturing Environment

The Virtual Manufacturing Environment (VME) is intended to assist the applications programmer in the creation of computer-aided manufacturing software. For example, the VME should allow the programmer to access the CAD data structure and the Product Information data structure and program machining functions to machine a part. The VME should also allow the applications program to access "virtual tools" and set up a "virtual shop" environment.

The Expert Consultation Environment

The Expert Consultation Environment (ECE) should allow the applications programmer to create, modify and utilize an expert system, the Expert Technician (ET), for the applications program and ultimately, the applications program user. The ET should have access to the CADMADE data structures and the Knowledge Base which is pre-defined during the creation of the CAD/CAM system and/or modified by the applications program user. The ET can be used by the applications program in a number of different operating modes which closely approximate the different ways in which a design/manufacturing engineer consults with an expert.

The Databases

The Universal database is a relational database which can be used by the applications program to store and retrieve any type of data. The applications programs can use the Universal database through the Universal database manager. The Knowledge Base contains information which is used by the Expert Technician (ET). The applications program can store information in and retrieve information from the Knowledge Base

with the help of the Knowledge Base Manager. The Expert Technician should also have the ability to modify the Knowledge Base.

6. The User Interface Environment

The User Interface Environment (UIE) of CADMADE contains high-level procedures which assist the applications programmer in quickly setting up a customized user interface for a CAD/CAM applications program. PHIGS includes most of the 3-D graphics primitives and graphical input devices necessary for the development of an interactive graphical user interface. But engineers who develop CAD/CAM systems based on the PHIGS standard spend a great deal of time in implementing some of the common features of a user interface such as menus, Icons, message areas, etc. For example, thousands of lines of PHIGS-based support software may have to be written for each new application program to implement a system of hierarchical menus.

The UIE of the proposed CADMADE should include interfaces which relieve the programmer of such time consuming and intricate programming. Figure 4 shows an expansion of the UIE from Fig. 3. The UIE mainly consists of:

1. The Menu and Icon Interface
2. The User Communication Interface

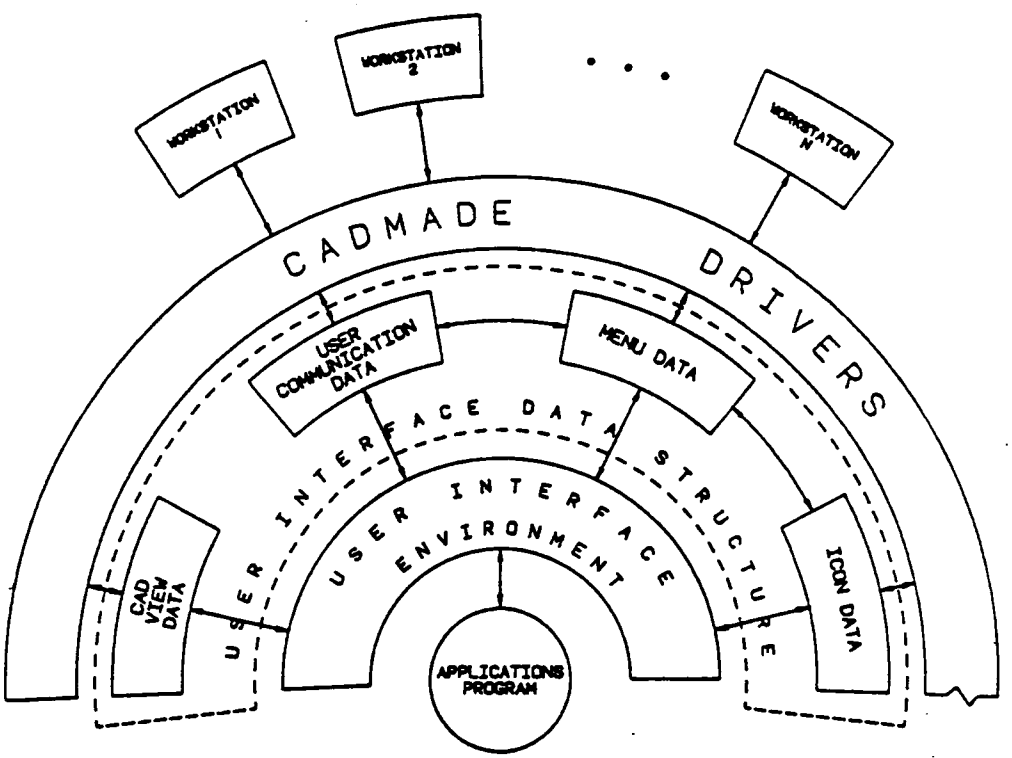


Figure 4. Overview of the User Interface Environment

6.1 The Menu and Icon Interface

The Menu and Icon interface should allow the applications programmer to program sets of hierarchical menu structures as part of the user interface for the applications program. The UIE should manage the organization and display of menus by storing the menu data in a centralized data structure, the User Interface data structure.

6.1.1 Hierarchical Menu Data Organization

A menu in the hierarchical menu system is defined by a sequence of elements grouped into entities called "menu structures". These elements include output primitives, attributes, etc. Since a menu system will be defined by one or more menu structures, these menu structures relate to each other in a hierarchical network. Menu structures can reference (execute) other menu structures. Recursive menu structure invocations should not be supported.

A hierarchical network of menu structures is called a "menu tree". Each menu structure in a menu tree is referred to as a "node". There is a special designated node called the "root menu", from which all other nodes originate. A menu structure is a "parent" if it references other menu structures. It is a "child" if it is referenced by others. The "ancestors" of a menu structure are the menu structures from the root node to the

current node. Figure 5 shows a fairly simple menu structure network (menu tree). In this tree, the root menu invokes submenus 1, 2, 3 and 4.

Submenu 2 invokes submenus 2.1 and 4. Submenu 4 invokes submenus 4.1 and 4.2. It should be noted that any node in the tree can invoke any other node as long as the child node being invoked is not an ancestor of the node invoking it. Any child node can have more than one parent. In the example presented above, submenu 4 has two parents in the tree, submenu 2 and the root menu.

6.1.2 Menu Structure Elements

Each menu structure consists of a series of elements, the smallest components of a structure. The main elements which can be included in a menu structure are:

1. Menu Primitives
2. Menu Attributes
3. Menu Location
4. Menu Invocations

Menu Primitives

A menu primitive is an element that generates the actual graphical output. Without menu primitives there would be no graphical data to display for the Menu/Icon system. There are four types of menu output primitives defined in the UIE:

1. Menu Title Text

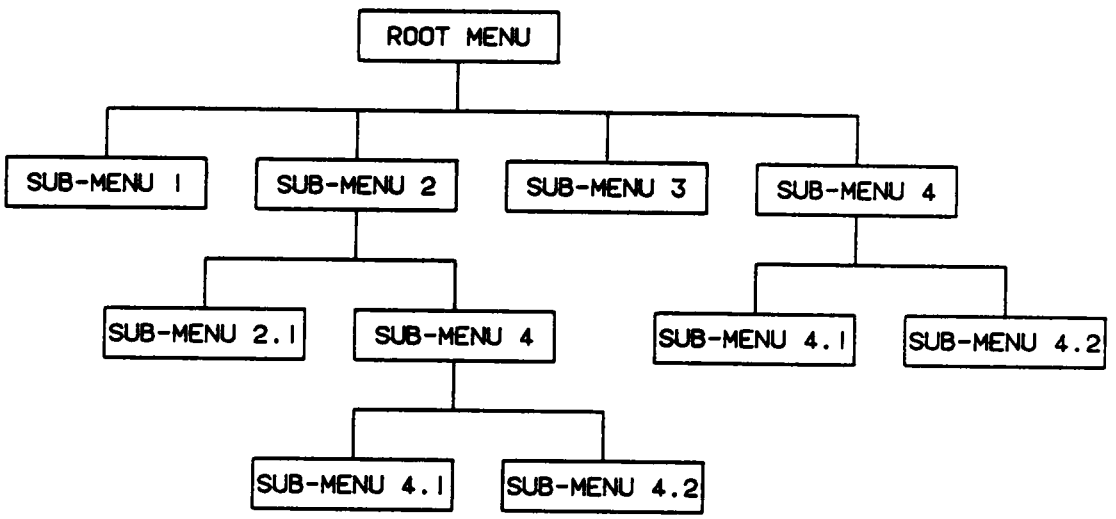


Figure 5. Example of a Menu Tree

2. Menu Item Text
3. Menu Title Icon
4. Menu Item Icon

Each menu output primitive is associated with a unique menu identifier. When a menu primitive is selected by the applications program user, CADMADE should return the identifier of the primitive selected to the applications program.

The Menu Title Text and the Menu Title Icon will allow the applications program to define a title for a menu screen. This title is usually a graphical entity which is descriptive of the function of the menus on the screen. The most common method of defining a menu title is by using a character string. The UIE should allow the application program to define a character string as a menu title by using the Menu Title Text Primitive. The Menu Title Icon should allow any graphical entity or group of graphical entities to be displayed as the title Icon for the menu. In order to use the Menu Title Icon primitive, the applications program has to define the graphics image in a PHIGS display structure. This PHIGS structure should then be used by the UIE to display the graphics image as a menu title Icon.

The Menu Item Text and Menu Item Icon are graphical entities which can be selected by the applications program user to indicate his/her intention (or choice) to the applications program. The Menu Item Text should allow the display of a character string as a menu item. Other graphics entities can be displayed as menu item Icons using the Menu Item Icon primitives. The Menu Item Icon should use PHIGS display structures in a manner similar to the one described above for the Menu Title Icon primitive.

Every menu primitive can have a polygonal area as a background. This polygonal area is similar to the PHIGS Fill Area primitive and should be defined when the menu primitive is defined. This feature will allow the menu primitive to have rectangular, circular or other shapes in the background to improve visibility and distinguishability of the menu primitives from the other graphics images which are displayed on the screen.

Menu Attributes

Associated with each menu primitive should be a set of attributes that define its appearance. The attributes which can be used to affect the appearance of the menu primitives are listed below.

Text Attributes:

Text attributes affect the appearance of a character string on the display screen. These attributes apply to the Menu Title Text and the Menu Item Text.

Text Font - Selects a workstation character font.

Text Precision - Controls how accurately the characters represent the specified text attributes.

Character Spacing - Controls how far apart characters are spaced. The value is specified as a fraction of the font's nominal height.

Character Expansion Factor - Controls character width. It is the multiplicative factor applied to the nominal character width.

Character Height - Specifies the height of upper case characters. The value is specified in normalized device coordinates units.

Text Color Index - Selects a text color. The value is an index into the workstation color table.

Character Up Vector - Specifies the up direction of characters. This controls the angle of the text strings.

Text Path - Selects the writing direction of text strings: up, down, left or right.

Text Alignment - Positions the string at a starting location. It has two components, one for the horizontal alignment and one for the vertical alignment.

The text attributes described above are similar to the text attributes defined in PHIGS. At any given time during menu structure traversal, there should be two sets of menu text attributes which are active: one for the menu title text and one for the menu item text.

Background Attributes:

Each menu primitive can have a fill area as a background. The attributes of the background are listed below:

Interior Style - Specifies how the polygon is filled. The styles that may be selected are - solid, hatch, pattern, hollow and empty.

Interior Style Index - Selects an interior pattern or hatch style from a workstation pattern or hatch table.

Interior Color Index - Selects an interior color from the workstation color table.

Outline Flag - Specifies whether or not the background polygon's edges are to be displayed.

Outline Type - Selects a line pattern for the background outline (e.g., solid, dashed, dotted, etc.).

Outline Width Scale Factor - Determines the line thickness for the background outline. It is specified as a multiple of the workstation's nominal line width.

The background attributes defined above are similar to the fill area attributes defined in PHIGS. At any given time during menu structure traversal, there should be two sets

of menu background attributes which are active: one for the menu title and one for the menu item.

Other Attributes:

Menu Title Icon Transformation Matrix

This attribute specifies a transformation matrix to be applied to the PHIGS structure which is to be used as a Menu Title Icon. This matrix will allow the PHIGS image to be rotated, scaled and translated before being displayed as an Icon. Using this feature will allow applications programs to also have animation sequences for Icons.

Menu Item Icon Transformation Matrix

This attribute has the same effect as the Menu Title Icon Transformation Matrix except that this matrix defines the transformation for the Menu Item Icon and not the Menu Title Icon.

Menu Prompt

Most menu-driven applications programs prompt the user by sending a character string to the display screen. Usually, this prompt is unvarying for a particular menu screen. Thus, a menu prompt can be included as an attribute for a menu structure. Whenever a menu screen is displayed, the appropriate menu prompt should be automatically displayed using dialog areas (discussed later in this chapter).

Menu Prompt Dialog Identifier

This attribute attaches a dialog area to the menu structure for the display of prompts.

Menu Locations

The menu locations specify the location, orientation and extent of the menu items defined in a menu structure. The menu locations can be defined in two ways:

1. Individual
2. Bundled

In the "individual" mode, the applications program has to define the location of each menu item individually. The menu item primitive invocation also has to define a background polygon for each menu item.

In the "bundled" mode, the applications program needs to define only one rectangular area for the menu items. A "bundled" locations path can also be defined by the applications programmer (up, down, left or right). CADMADE should automatically space the menu items in the rectangular area following the predefined bundle location path.

The menu locations should be defined by the applications program using Normalized Device Coordinates (NDC) system.

Menu Invocations

Menu structure invocations are the elements used for building hierarchical menu trees. For example, one menu structure "executes" another which "executes" another, and so on, once for each level of hierarchy. The "Execute Menu Structure" element causes traversal of a specified menu structure. CADMADE should automatically save the current system state before transferring control, and restore the current system state

when control returns to the parent structure. This transfer of control is explained in greater detail in the next section, "Menu Structure Data Display".

Menu Structure Labels

A label is a menu structure element which has no effect on the appearance or the hierarchy of the menus. It serves as a marker to facilitate structure editing.

6.1.3 Menu Structure Data Display

Traversal

In order to display a menu structure network, the "traverser" starts from the root node and processes each element in sequence. Each menu primitive is rendered with the current attributes. For example, the menu tree shown in Fig. 6 will be traversed in the following order for setting the menu attributes:

1-2-1-3-5-3-6-3-1-4-1

Thus, the traversal of a menu structure is temporarily suspended when an "execute menu" element is encountered. The traversal of the parent is resumed when the traversal of the child is complete. The actual time of traversal, however, should be controlled by the applications program as described in Section 6.1.7. In order to display a menu from a menu tree, the root menu has to be "posted" to the workstation. The menu display entities have a higher display priority than any other graphics entity on the display surface. The "Unpost Menu Root" function removes a menu tree from the workstation.

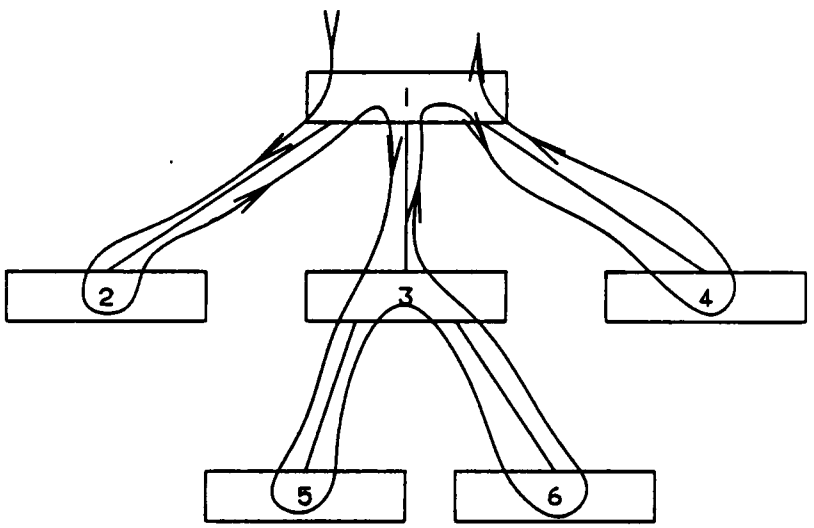


Figure 6. Example of a Menu Tree Traversal

The *workstation state list* should include a "current menu list" which consists of a current menu for each menu tree posted to the workstation. Only the current menus should be available to the applications program user for menu selection.

Traversal Time Binding

The menu primitive attributes and locations should be assigned to primitives during traversal of the structure and not at the data definition time. In the example of a menu structure shown in Fig. 7, the menu item "One" is displayed at (0.3, 0.3) in red with a hollow background and the menu item "Two"is displayed at (0.6, 0.6) in green with a hatched background (Fig. 8).

Inheritance

Attributes defined within a menu structure should subsequently affect the menu primitives in children structures. Thus, a child menu structure "inherits" attributes of its parent. If a child menu structure is instanced more than once, each instance should inherit the attributes of its immediate parent. The root menu structure should inherit its attributes from the CADMADE description table which should contain the system default values. The attributes of a child structure are different from those of the parent only if the attributes are defined within the child itself. Thus, the same menu structure can be invoked from several parent menus with different attributes being associated each time (when the attributes are inherited) or with the same attributes each time (when the attributes are defined within the child menu structure).

The menu location elements of menu structure should also be inherited from parent menus unless they are redefined in the children menus. Thus, the applications programmer has the flexibility to easily bring up submenus in the same menu area or have submenus come up at different locations on the screen.

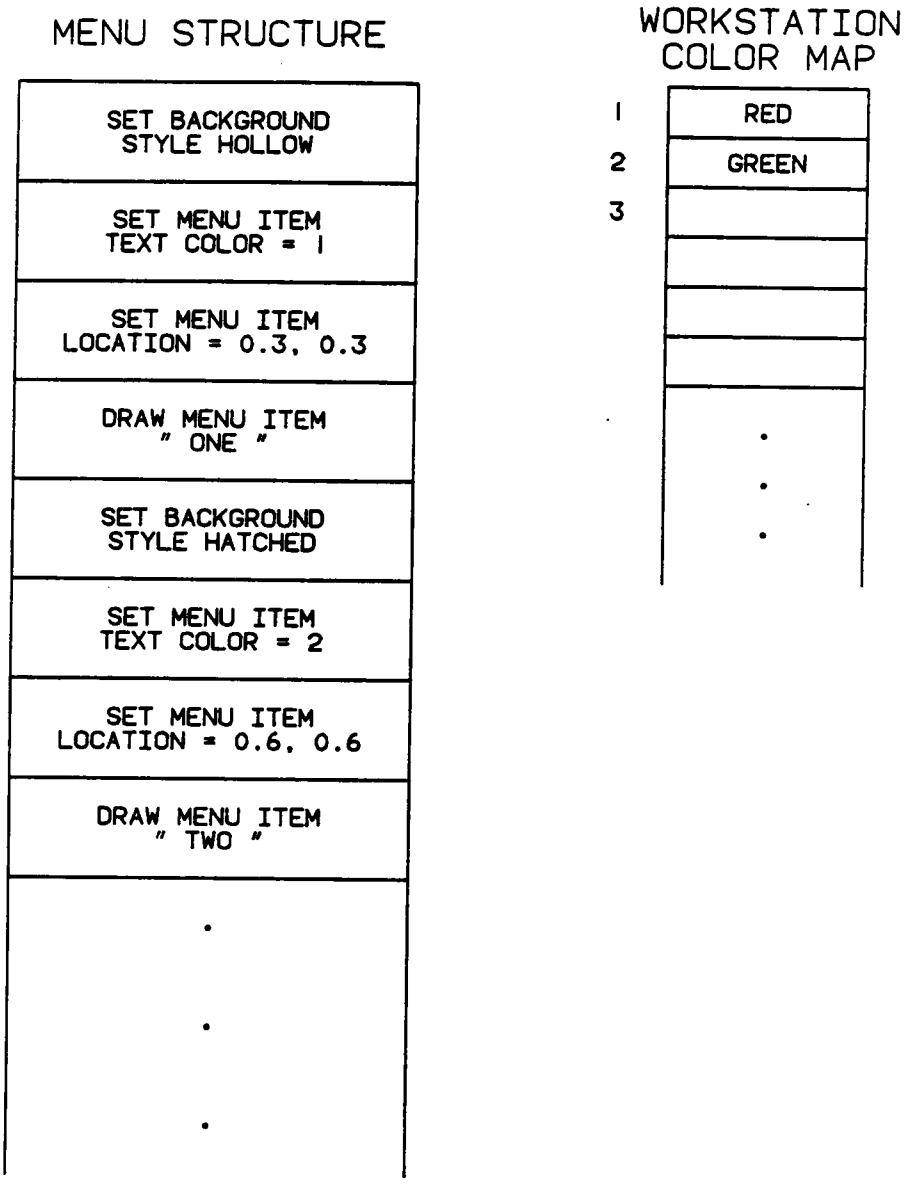


Figure 7. Menu Structure for Example of Traversal Time Binding

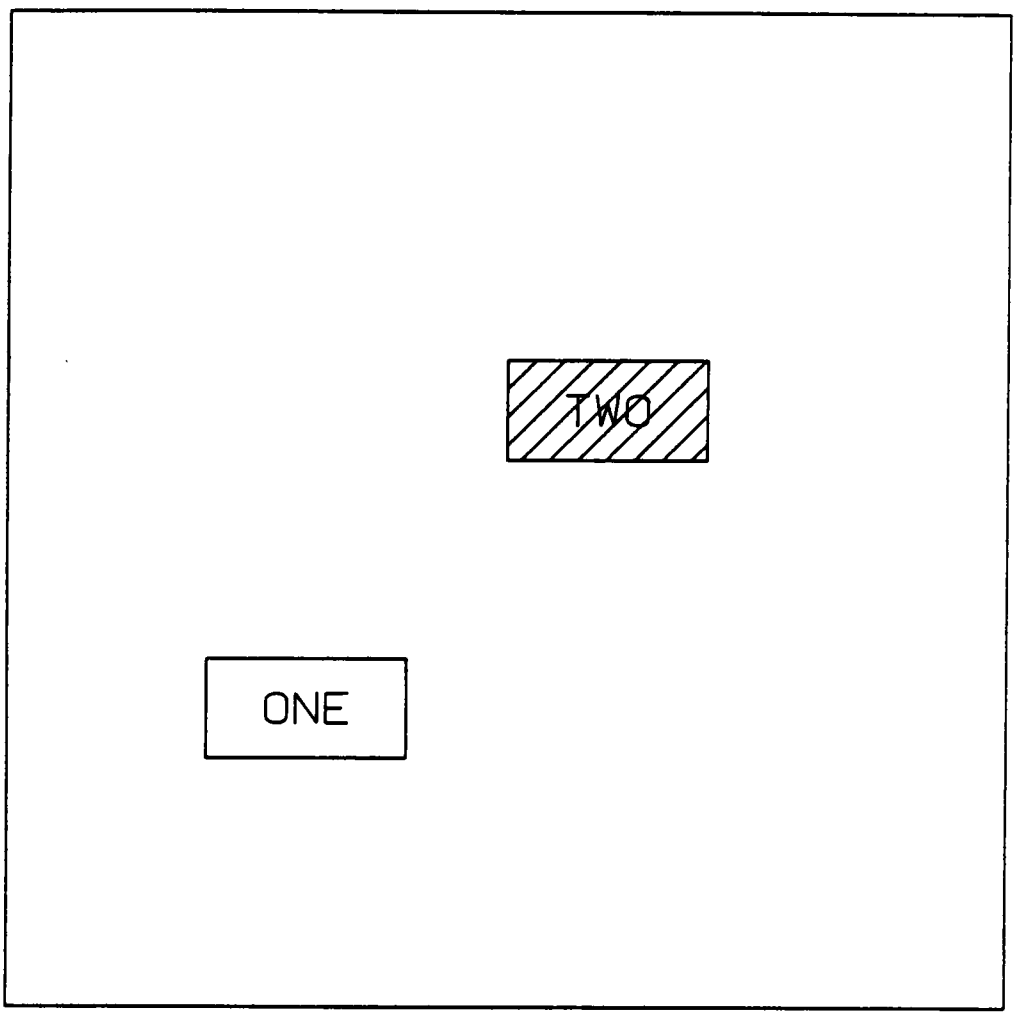


Figure 8. Example Result of Traversal Time Binding

The useful consequences of hierarchy are:

1. Compactness of data storage.
2. Guaranteed consistency in case of multiple invocations of the same menu structure.
3. Ability to control the appearance of the menus at traversal time.

6.1.4 Menu Structure Editing

Menu data in the Menu data structure can be modified by menu structure editing. An element pointer should point to a location in a menu structure, and modifications made to the menu structure should be dependent on the location of the element pointer. The "Open Menu Structure" command should open a menu structure in the menu data structure for editing. If the menu structure does not exist, a new menu structure should be created. The "Close Menu Structure" should end the editing of the menu structure. The editing capabilities of the menu structure editor should include:

1. Move element pointer
2. Insert element
3. Delete element or range of elements
4. Copy contents of a structure
5. Inquire elements
6. Locate element pointer at label
7. Empty menu structure
8. Delete menu structure

6.1.5 Menu Types

Two types of menus have been defined for CADMADE:

1. Global menus
2. Local menus

A global menu is a menu tree which should be always available to the applications program user unless it is specifically unposted by the applications program. A local menu should be available to the applications program user only if it is the "current" menu in the posted menu tree. A global menu can invoke a local menu but a local menu cannot invoke a global menu. Only one global menu tree can be defined in CADMADE at any given time. A global menu tree can be defined by setting up a regular menu tree and assigning the root of the menu tree to the global menu root.

6.1.6 The Menu Pick Logical Input Device

An input device is a device which an applications program user uses to generate graphical input to the applications program. A logical input device is an abstraction of physical input devices with similar characteristics and input behaviors.

Physical input devices include keyboard, thumbwheels, light pens, tablets, mouse, dials, etc. The applications program has to map each logical input device to a physical input device which the program user can manipulate. PHIGS supports six classes of logical input devices:

1. Locator
2. Stroke
3. Valuator
4. Choice
5. String
6. Pick

For the UIE of CADMADE a seventh class of logical input device has been defined, the "Menu Pick" device. In order to allow the application program to pick the displayed menu primitive, each menu primitive should have a menu pick identifier associated with it which is returned when the primitive is selected. The menu pick should return a menu pick path which identifies the menu primitive picked. This path should also return the menu structure in which the primitive is defined and the menu structure path from the root menu to the picked menu. All physical devices which are capable of PHIGS pick input should also be capable of menu pick. In certain cases, the applications program user should be able to key in a menu selection using a string device. This feature is further discussed in section 6.2.2.

PHIGS supports three operating modes for the logical input devices:

1. Request
2. Sample
3. Event

The menu pick input should be capable of operating in all the three above-mentioned modes for PHIGS compatibility.

6.1.7 Applications Controlled Menu Structure Traversal

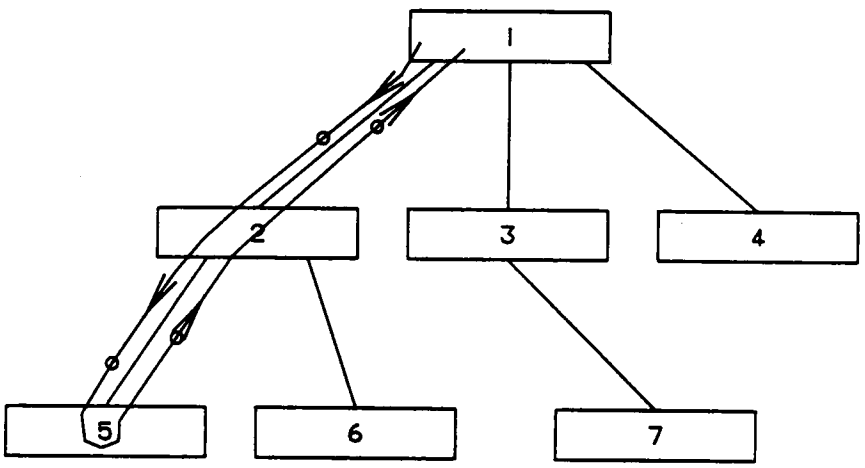
The menu structure traversal in CADMADE should be partially controlled by the applications program. When a menu structure is invoked within another menu structure the following actions should occur:

1. The parent menu structure is made unpickable.
2. The parent menu structure may or may not be set invisible (depending on the applications program).
3. The attribute values of the parent are passed on to the child.
4. The child menu is made visible and pickable.
5. Control is passed back to the applications program.

The invocation and display of the submenu structures should be controlled by the applications program. When a root menu is posted, it should be added to the current menu list on the workstation and all the menu output primitives in the menu structure should be displayed. Control should then be returned to the applications program. After a "menu pick", the applications program should be able to get the hierarchical menu pick path from CADMADE. The applications program can then invoke a procedure to continue the menu structure traversal and automatically display the next menu in the hierarchy depending on the menu item selected. The applications program has to pass the menu pick path of the menu pick back to CADMADE. The new menu should be added to the list of current menus on the workstation state list and the previous menu removed from this list. Thus, the traversal time of a menu structure will be controlled by the applications program. This feature will allow the applications program to perform other necessary operations before a new menu is displayed. If the

lowest element in the menu pick path indicates a return, the current menu should be removed from the workstation current menu list and the parent of the current menu added to the list of current menus on the workstation. A predefined menu pick identifier should display the global menu and add the global menu to the workstation current menu list (if it is not already there). This pick identifier can be attached to any menu item in a menu tree.

Figure 9 shows an example of a menu tree with a sample sequence of menu picks. In this example, the applications program first posts menu structure 1. The traverser displays menu structure 1 and returns control to the applications program. At this time, the applications program can perform computations called for by the selected menu item. For example, if the applications program user selects a menu "DISPLAY", the applications program has to do the necessary computations and display a model on the graphics screen before allowing the user to select another menu item. After the application program user selects menu 2, the applications program calls "next menu" which automatically traverses menu 2 and displays it. Similarly, the menu structure 5 is displayed when the user selects menu 5 and the application program invokes "next menu". When the user selects a return from menu 5, the previous menu (2 in this case) is displayed (when the application program invokes the next menu function). This sequence of events is shown in Fig. 10. Similarly, another return selection displays the root menu structure once again.



o - CONTROL RETURNED TO THE APPLICATIONS PROGRAM

MENU PICK SEQUENCE :

2 - 5 - RETURN - RETURN

Figure 9. Example of a Sequence of Menu Picks

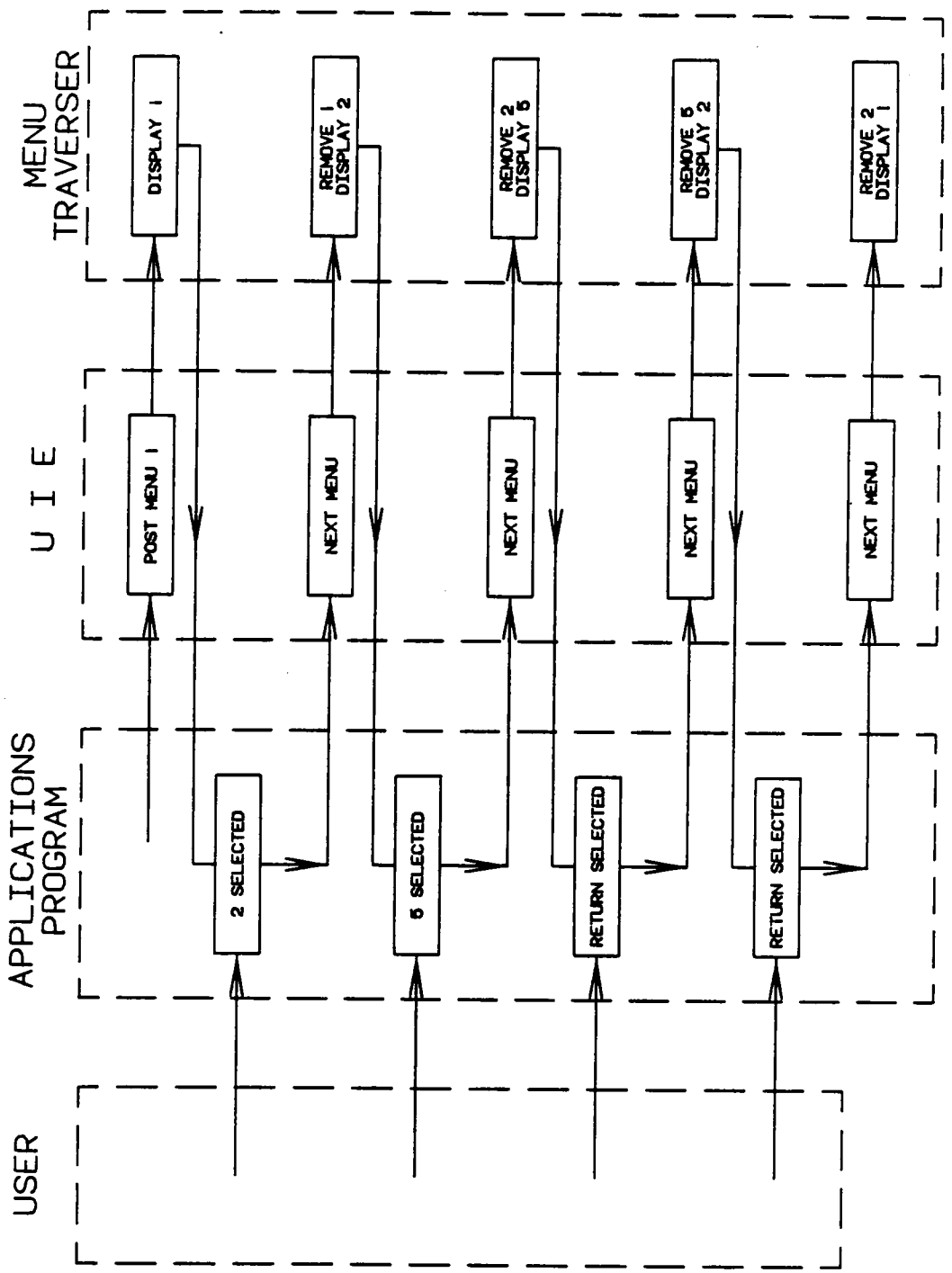


Figure 10. Applications Program Controlled Menu Traversal

6.2 The User Communication Interface

The User Communication Interface of the UIE should allow the applications program to communicate with the applications program user through rectangular windows. These windows are called "Dialog Areas". These dialog areas are meant only for text (character) input/output. The dialog areas should be simple to define and use. They should not be as complicated to use as X windows or NeWS. The user communication interface is not a full-fledged window manager, but it should allow easy creation of rectangular windows for user input/output. Using the user communication interface, the applications program can set up multiple dialog areas on the display surface.

6.2.1 Dialog Areas for Applications Program Input/Output

PHIGS implementations support various logical input devices which can be mapped to the alphanumeric keyboard as the physical device. For example, the "valuator" can get numeric input from the user through the keyboard and the "string" can get text input from the user through the keyboard. In order to use any of these input devices, the applications programmer has to go through a series of procedures to initialize the logical input devices and associate them with the physical devices.

The user communication interface will greatly simplify the use of the keyboard for string and valuator input. Any keyboard input to a dialog area should be considered as string input. A utility procedure supported by the UIE should allow the applications program to extract number input from the string input to the dialog area. Thus the same physical

device (the keyboard) can be used for both string and valuator inputs without having to go through the process of initializing the devices and then getting the input from the devices.

The dialog areas should also allow the applications program to display messages. In PHIGS, in order to display a message text, the text string has to be inserted in a PHIGS structure along with its attributes and then posted to a workstation and a view. In order to change the message, the PHIGS structure has to be edited and the image regenerated. Having a message area with multiple lines of message and scrolling messages is much more complex to program. PHIGS does support a "message" function but the applications program has no control over the location, attributes, etc. of the output text and cannot have scrolling messages or multiple lines of messages.

The user communication interface will greatly simplify the process of sending messages to the screen. The dialog areas can display applications program defined message strings. The attributes of these text strings are controlled by the attributes of the dialog area (discussed below). Thus the applications program has to define the dialog area once and then can display messages at any time by invoking only one message function.

6.2.2 Dialog Areas for Menu/Icon Interface Input/Output

The dialog areas can also be used for input/output related to the Menu/Icon interface. Inside a menu structure, a prompt string and a dialog area identifier can be inserted as attributes of the menu structure. The UIE should automatically send the prompt string as a message to the specified dialog area whenever the menu is added to the list of current menus on the workstation state list. This feature blends well with the feature

of automatically bringing up selected submenus, since the applications programmer does not have to keep track of the appropriate prompts for the various menu levels.

The dialog areas can also be used for menu input from the applications program user. Each dialog area can be associated with one root menu structure. A keyboard string input, with a predefined character prefix, to the dialog area should be associated with menu input for the menu tree with which the dialog area is associated. The character prefix which indicates a Menu/Icon input can be defined by the applications program. When CADMADE receives a string input with the special prefix, it should search the current menu item text strings to locate the most probable menu item that can be selected by the user and generate a hierarchical menu pick event which can then be treated as a regular hierarchical menu pick. In case of any ambiguity in the string menu input, the first menu item text that matches the input string should be taken as the menu input item.

An example of a menu tree which can cause ambiguity in string menu selection is presented in Fig. 11. In this example, when "MAIN" is the current menu, a menu string input of "SUB" could be ambiguous, but CADMADE returns a menu pick identifier of "2" corresponding to the first menu item text which has "SUB" as a sub-string. A menu input of "SUB 3", however, is not ambiguous and the menu pick identifier returned is "4". This string menu selection feature can allow the applications programmer to go to any node in the tree just by keying in a set of menu strings. This is similar to the type-ahead feature found in many menu systems.

An analogy can be drawn between the menu string input and the "change directory" command in UNIX and other operating systems. In UNIX, the sub directories are arranged in a hierarchical tree. For example, UNIX command "cd /usr/menu" would

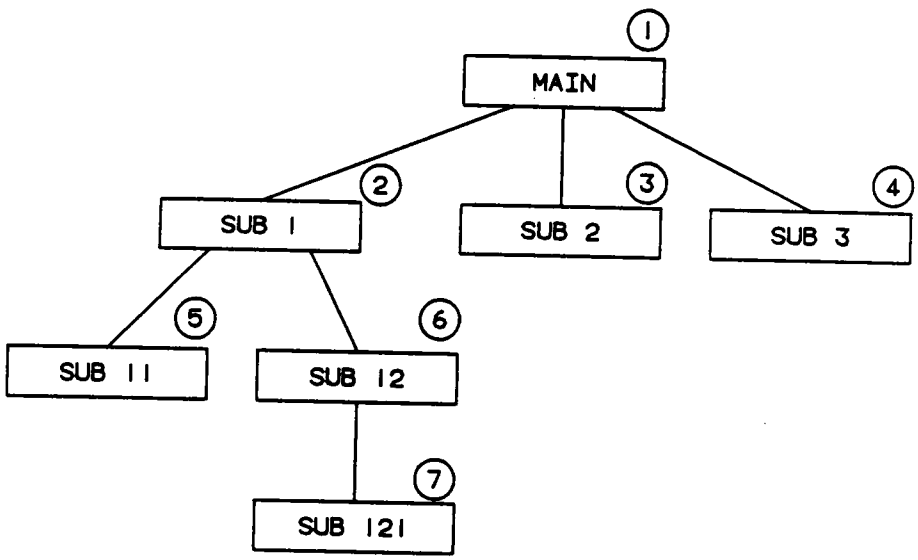


Figure 11. Example of a Menu Tree for String Menu Selection

take the user to the directory "menu" shown in Fig. 12. The first "/" indicates that the change directory command starts from the root directory. A similar feature should allow the applications program user to change menus and traverse the menu tree by keying in "change menu" commands. For example, if "cm " is defined as the prefix for menu input, the string input of "cm SUB 1" to the appropriate dialog area should generate a menu pick identifier of 2 and a pick hierarchy of 1-2 (when "MAIN" is the current menu, Fig. 11). A string input of "cm /SUB 1/SUB 12/SUB 121" should generate a menu pick event with a menu pick identifier of "7" and a menu pick hierarchy of 1-2-6-7.

6.2.3 Dialog Areas and Host System Communication

The UIE dialog areas can also be used to allow the applications program user to communicate with the host computer system during applications program execution. This concurrent processing of system commands during applications program execution can be made possible with the use of multitasking operating systems like UNIX. Although a number of window managers (X-windows, NeWS, etc.) allow the user to define multiple windows for host system communication, the CADMADE dialog area should allow the system commands to go through the applications program. Using the user communication interface, the applications program can issue host system commands directly or allow the applications program user to issue system commands.

In a manner similar to the one described above for string input for menu selection, the applications program can define a character prefix which signifies a host system command. A dialog area can be attached to logical input/output units by defining a logical unit number for the dialog area. When CADMADE receives a string input with

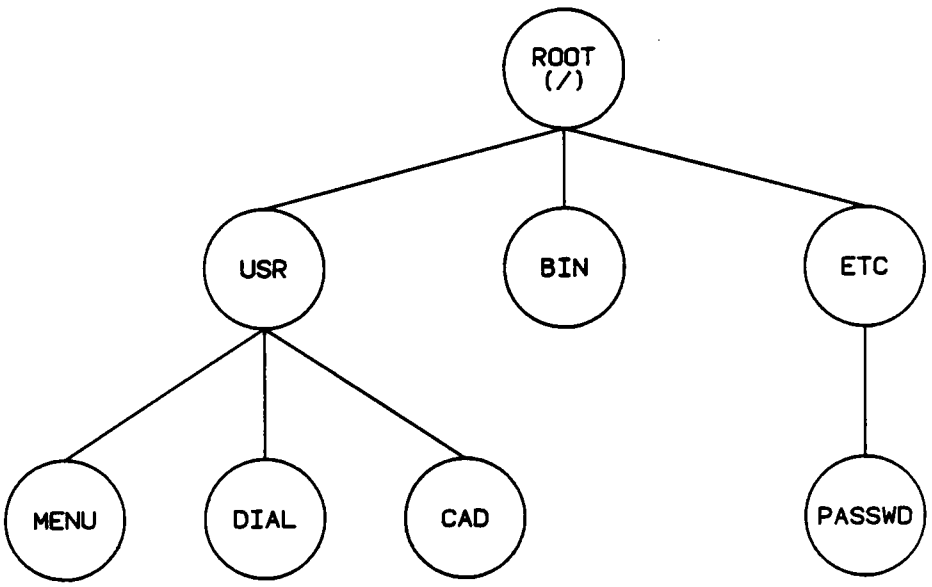


Figure 12. Example of UNIX File Hierarchy

the special prefix, it should send the character string (after stripping the prefix) to the host computer as a system input from the logical unit to which the dialog area is attached.

An example of the use of such facilities is allowing the applications program user to view a list of files and modify data files during applications program execution.

6.2.4 Dialog Area Attributes

Each dialog area should have its own set of attributes which control the appearance of the dialog area. The attributes of the dialog areas should be stored in the *workstation state list.* Thus, any changes made to the attributes of the dialog areas will be instantly applied to the dialog areas being displayed. The attributes of dialog areas are:

Number of Lines : Specifies the number of lines of text (including the string input line) to be displayed in the dialog area.

Number of Characters per Line : Specifies the maximum number of characters to be displayed in each line in the dialog area.

Dialog Echo Mode: Specifies whether inputs to the dialog area should be echoed back to the dialog area as a message.

Dialog Scroll Mode: Specifies whether the dialog area lines are to be in scroll mode or overwrite mode.

Dialog Area Location: Specifies the corner points of the rectangular dialog area in Normalized Device Coordinates (NDC).

The rest of the dialog area attributes listed below perform functions similar to those of the attributes described for the menu text and the menu background area.

- *Dialog Area Character Height*
- *Dialog Area Character Spacing*
- *Dialog Area Character Expansion Factor*
- *Dialog Area Text Color Index*
- *Dialog Area Text Font*
- *Dialog Area Text Precision*
- *Dialog Area Background Flag*
- *Dialog Area Outline Flag*
- *Dialog Area Background Color Index*
- *Dialog Area Outline Color Index*
- *Dialog Area Background Interior Style*
- *Dialog Area Background Interior Style Index*
- *Dialog Area Outline Type*
- *Dialog Area Outline Width Factor*

6.2.5 Other Features of Dialog Areas

Some attributes of dialog areas should not be stored in the workstation state list. These attributes affect the dialog areas only when the workstation is updated. The following is a list of such attributes:

Dialog Area Buffer Size: The buffer size of a dialog area specifies the number of lines of input/output to be retained in the buffer.

Dialog Area Visibility: A dialog area can be rendered visible/invisible by setting the dialog area visibility.

Dialog Area Priority: Each dialog area should have a priority similar to the view priority supported by PHIGS. The priorities of the dialog areas should decide how overlapping dialog areas appear on the screen.

Dialog Area Scroll: A function in the UIE should allow the applications program to scroll up or down in the dialog area within limits of the dialog buffer. In order to be able to use this function, the dialog area must be in scroll mode.

6.3 The CAD View Manager

PHIGS supports viewing transformations which map world coordinates into viewing coordinates. The viewing transformations define the orientation, location and display of a PHIGS graphics structure on the display surface. Viewing transformations are defined by view matrices stored in the workstation state list view table. These viewing facilities give the applications programmer enough flexibility to define and transform displays of structures in any desired manner. However, certain operations involving these viewing transformations are important to CAD/CAM applications and involve large amounts of repetitive code which are usually duplicated from applications program to applications program. The CAD View Manager is designed to make these sets of operations available to the applications programmer as higher level procedures, thus eliminating the time and effort spent in rewriting large portions of computer code.

6.3.1 Predefined Views

Most CAD/CAM applications/systems set up principal orthographic views and isometric views for the display of CAD models. These views are defined using PHIGS viewing facilities or other device-dependent viewing functions. In order to define these commonly used views, the applications program has to calculate the transformation matrices from the transformation values (translations, rotations, etc.) and apply these matrices to the views.

The UIE should allow the applications program to invoke higher level procedures and display CAD objects in such predefined views in a simple and easy manner. The applications program need only identify the view index and a view transformation index to display a predefined view. The seven principal views which should be supported by the UIE are shown in Fig. 13.

Other than the default predefined views, the UIE should also allow the applications program to store viewing transformations and create "applications-defined predefined views". The applications program can store the current viewing transformation of any view by specifying a "predefined view transformation index". This predefined view transformation index must be different from the indices used by the seven default predefined views. This applications defined viewing transformation can then be applied to any view to easily display models in commonly used views (other than the principal orthographic views).

6.3.2 Nonrectangular Windows

PHIGS view facilities only allow the creation of rectangular windows and viewports. It is not uncommon for designers to use nonrectangular windows for special cases. One example of the use of a nonrectangular window is demonstrated in Fig. 14. In this case, a circular window is used to display a magnified view of a part of model to show the details of the part. Device-independent viewing standards should allow the applications program to define such nonrectangular views.

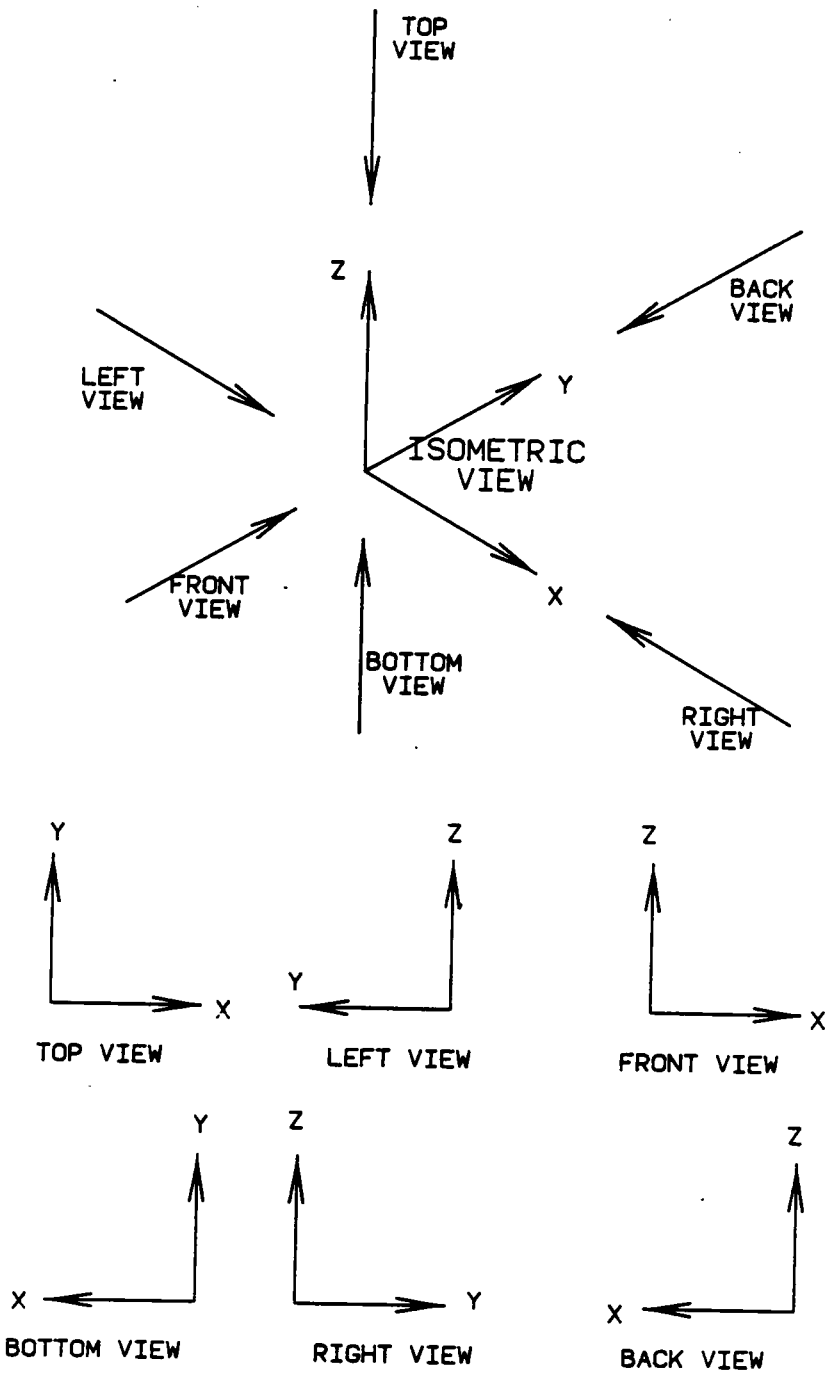


Figure 13. Predefined Principal Orthographic Views

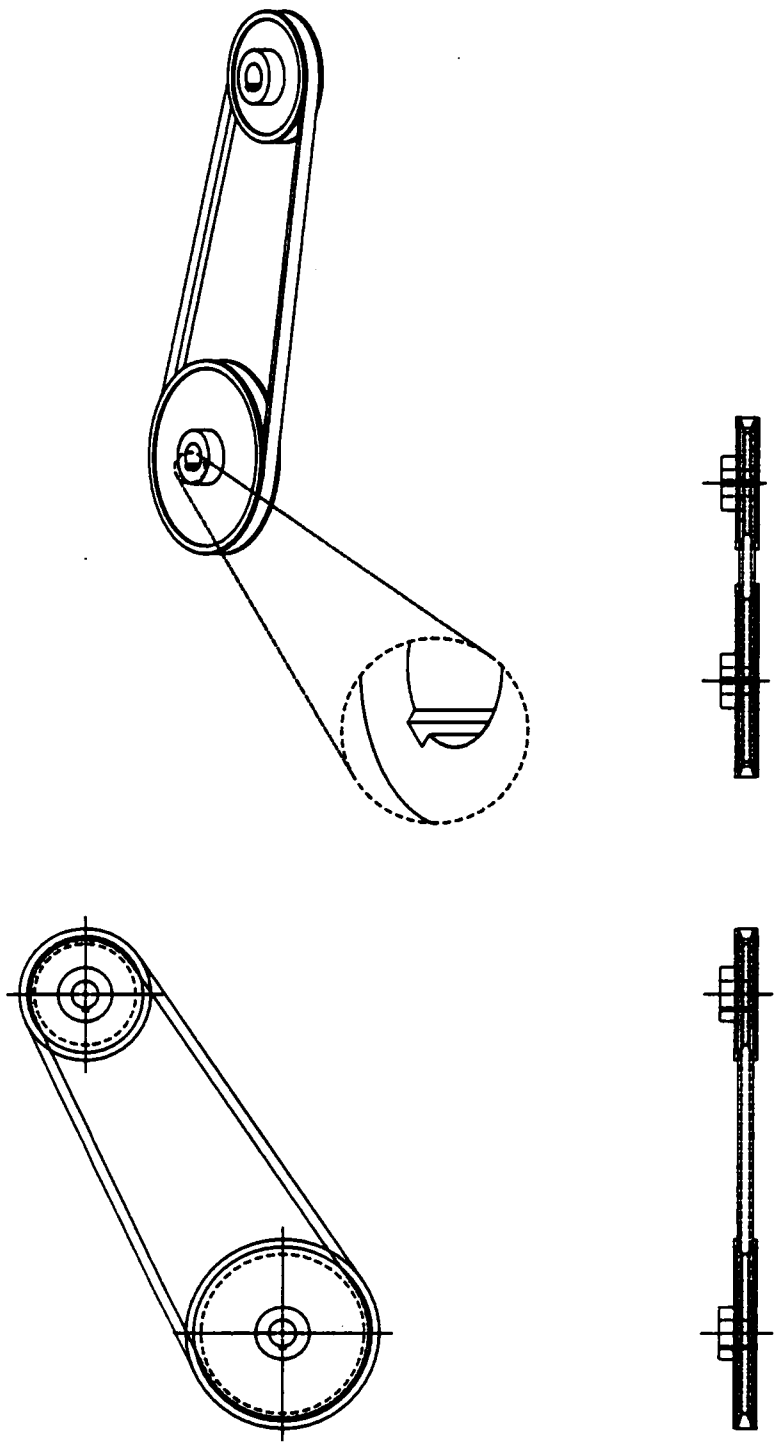


Figure 14. Example of Use of Nonrectangular Window

The CAD view manager should allow the creation of nonrectangular windows by allowing the applications program to define any polygonal shape for the window and viewport. The only limitation should be that the number of sides of the polygons for the window and viewport must be the same in order to avoid distortion of the image during mapping from the world coordinate system to the viewing coordinate system. The polygon defining the window should have available to it all the attributes available to PHIGS fill area primitives. These attributes should define the background and border characteristics of the view.

6.3.3 User Interface for Viewing Transformations

A common feature found in many CAD/CAM applications/systems is the use of graphics input devices to allow the applications program user to apply viewing transformations to different views. Figure 15 shows a typical sequence of events followed by an applications program in order to allow the user to apply viewing transformations using valuator input devices and PHIGS.

The process of getting the valuator input, deciding on the transformation matrix and applying the matrix to a view are very commonly used and should be available to the applications programmer as one higher level procedure. This higher level function of the UIE should allow the applications program to attach logical input devices to PHIGS views for the automatic application of viewing transformation to views. CADMADE can accomplish this by maintaining two viewing transformation maps in the *workstation view table* . The seven commonly used viewing transformations which should be supported are the X, Y, Z translations and the X, Y, Z rotations and uniform scaling.

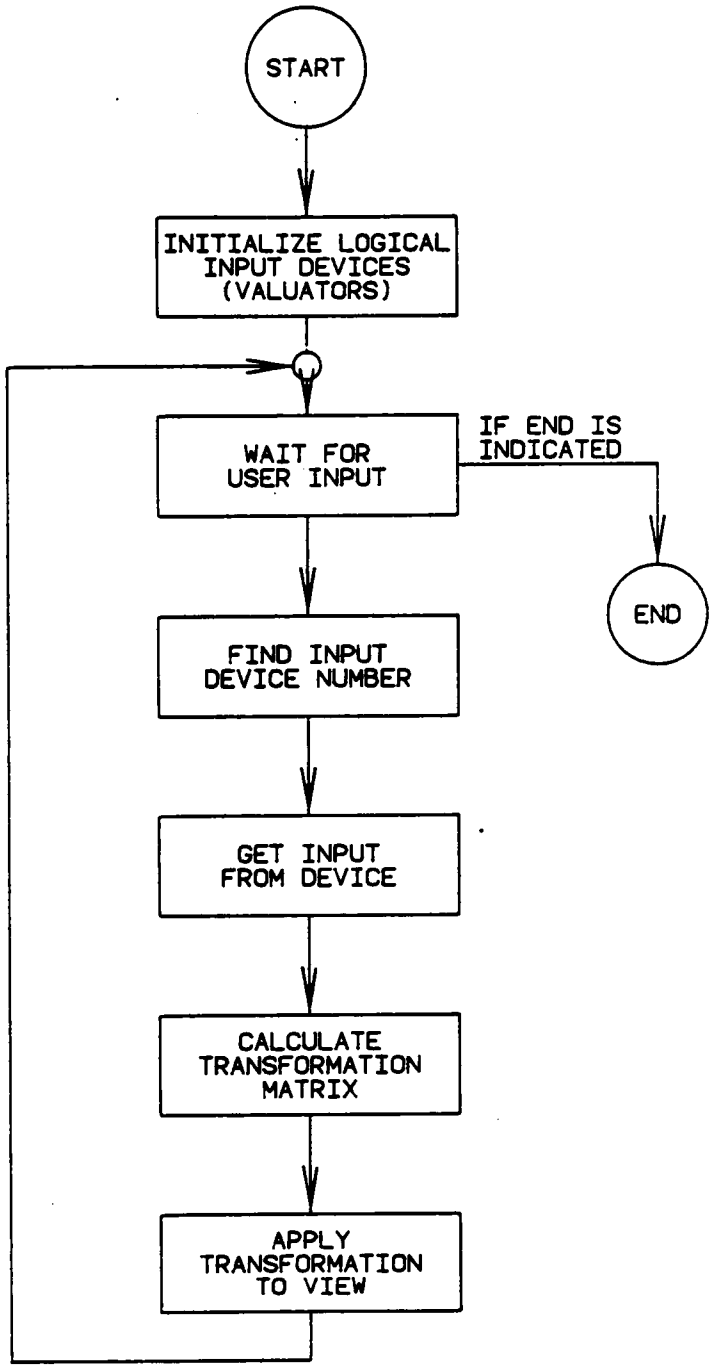


Figure 15. Applications Program for View Manipulation Using PHIGS

The first map (the logical-input-device-to-transformation map) maps the logical input devices to the above mentioned transformations. The second map (transformation-to-view map) maps the various transformations to view indices in the workstation's view table. Figure 16 shows an example of the CADMADE view transformation maps. Using this facility, the applications programmer need only initialize the logical input devices and define the above mentioned maps. When an input is generated by one of the input devices defined for viewing transformations, CADMADE should automatically go through the process of getting the input value and applying the transformation to the appropriate views. Figure 17 shows a typical sequence of processes followed by an applications program in order to use the automatic viewing transformation feature of CADMADE.

The automatic application of view transformations from input devices can make good use of the intelligent graphics devices which have been available in the market in recent years. For example, in CADAM-ISD, the dials attached to IBM 5080 graphics devices are set up for rotations, translations and scaling. However, these transformations are performed locally by an intelligent processor on the graphics device. Thus, these transformations do not use any processing time of the host computer system. Such local graphics device intelligence cannot be used if the applications program has to get the input and calculate the transformations. The use of CADMADE view transformation maps would allow device drivers to utilize the local intelligence of the graphics device and hence improve the performance of the display device. Thus, the applications program would use device-independent and machine-independent functions to improve the performance of viewing transformation processes on intelligent graphics display devices.

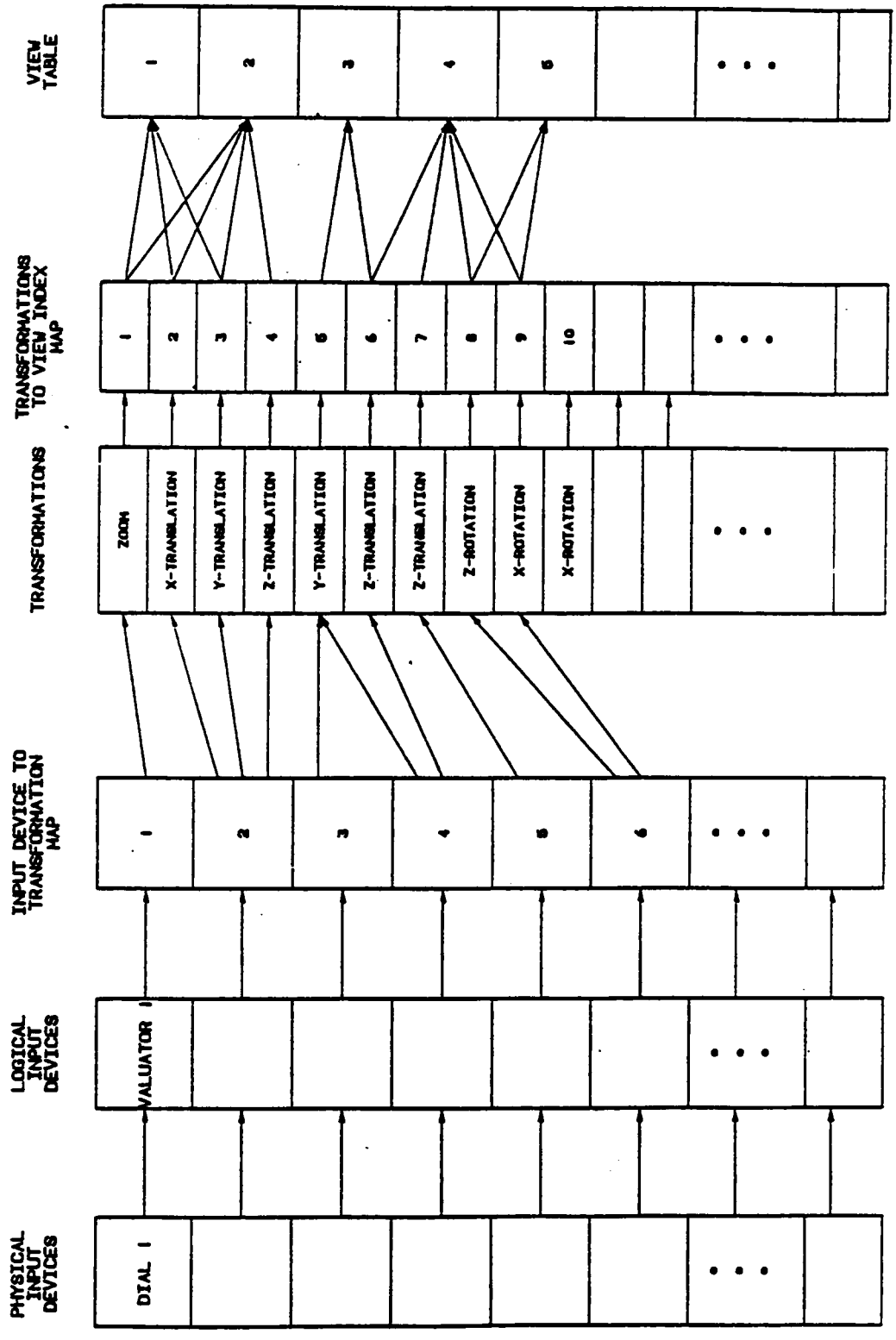


Figure 16. Example of CADMADE View Transformation Maps

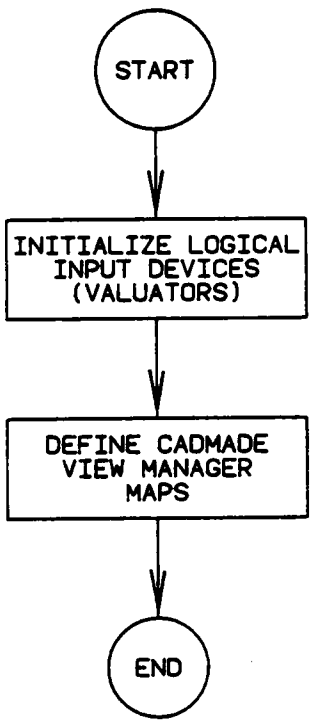


Figure 17. Applications Program for View Manipulation Using CADMADE

7. The Design and Modeling Environment

Geometric modeling is an important part of computer-aided design and manufacturing. The Design and Modeling Environment (DME) should provide the applications programmer with high-level geometric modeling procedures and other aids which facilitate the development of geometric modeling, design and analysis software. The DME should eliminate the time spent by CAD engineers in developing specialized procedures to describe and store shapes of objects using geometric modeling procedures. The applications program should be able to easily generate geometric data and store the data in the CAD data structure. Figure 18 shows an expansion of the DME from Fig. 3.

The DME consists of :

1. Modeling Entities
2. Modeling Operators
3. Analysis and Query
4. Modeling Utility Procedures

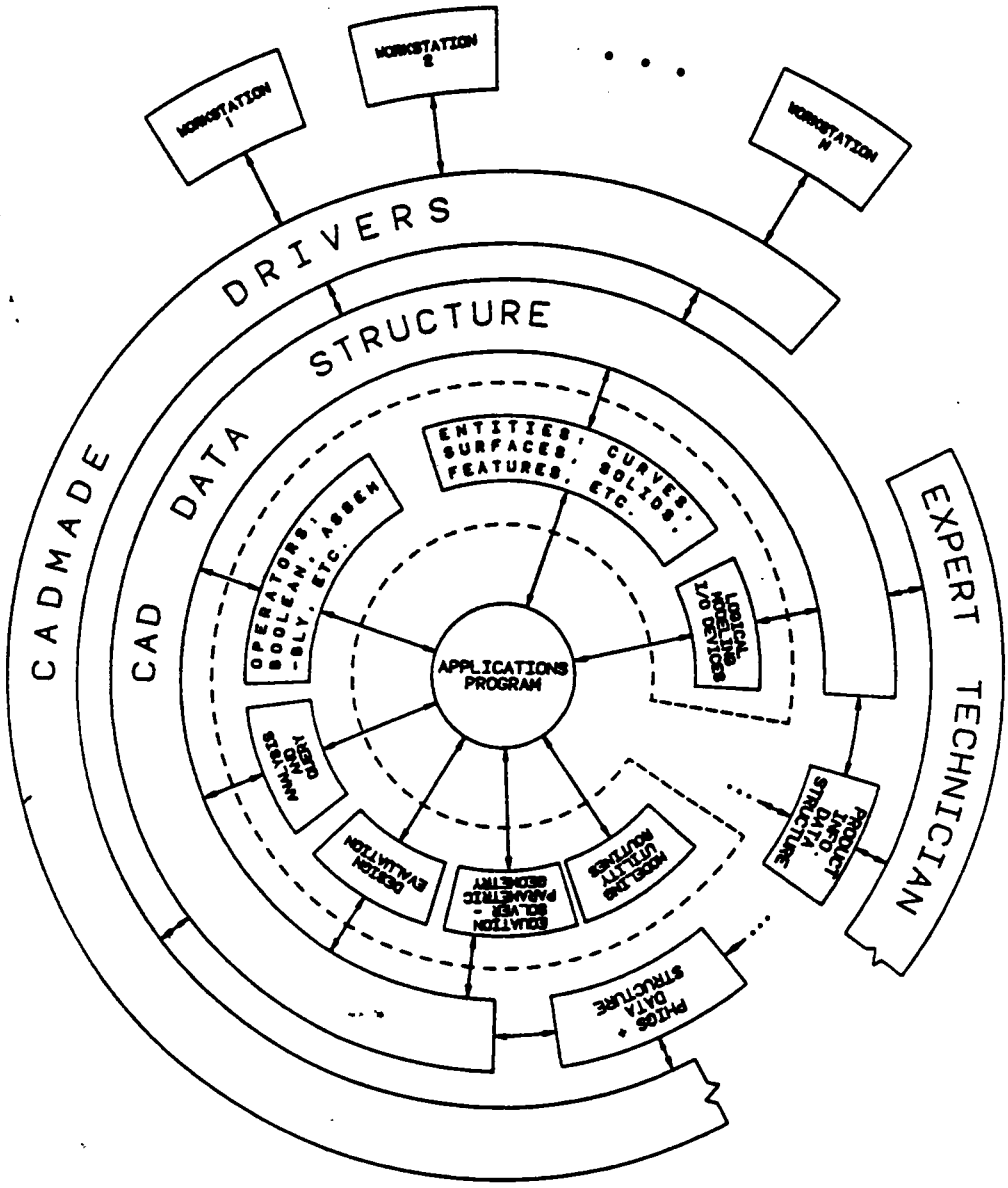


Figure 18. Overview of the Design and Modeling Environment

5. Logical Modeling Input/Output Devices
6. Equation Solver - Parametric Geometry
7. Design Evaluation

7.1 Modeling Entities

A geometric model can be described for CAD applications in a number of different ways. The most commonly used method for geometric modeling is "wireframe modeling" which uses curves and surfaces to represent a geometric shape. However, there are certain limitations of the wireframe modeling technique when three-dimensional objects are to be represented and analysed. "Solid Modeling" is intended to overcome these limitations and to allow the creation of unambiguous and complete geometric representations of objects. "Feature-Based Modeling" is a very new technique in geometric modeling in which similar shapes are grouped into a generic "feature" to allow designers to easily create commonly used complex shapes. The DME of CADMADE should support the creation of all three types of modeling: wireframe, solid and feature.

7.1.1 Wireframe Modeling

A wireframe model is composed of lines, curves and surfaces which define the edges and faces of an object. Each curve or surface is constructed separately and independently. The types of curves discussed below should be included in the DME.

Curves

Parametric Polynomial Curves: These curves include several forms of piecewise parametric three-dimensional curves. These forms are commonly described by an ordered set of three-dimensional points, a polynomial order and a "curve basis" which specifies the relationship of the resulting curve to the defining data. Parametric polynomial curves include Ferguson curves, Bezier curves, uniform B-splines, rational curves, etc.

The DME should support the creation of parametric curves in a number of different ways. For example, in generating a parametric cubic curve, the applications program can use the four-interpolating-point form, the Bezier form, or the two end point and two tangent form, or the specification of control points and weights for a rational cubic curve.

Nonuniform B-Splines have recently become very popular because of their localized curve control characteristics. The DME should support the creation of both rational and nonrational nonuniform B-Splines.

Spline curves are very important in the aircraft and ship building industries. Spline curves should be supported by the DME of CADMADE. Spline curves behave structurally like a beam, with bending deflections forming them into smooth curves.

Surfaces

The surfaces patches which should be included in the DME are:

1. Coons patch
2. Tensor product patch
3. Bezier patch
4. B-spline patch
5. Rational patches

The Coons patch is constructed solely in terms of information given on its boundary and certain auxiliary scalar functions. The blending functions used in Coons patches are linear and uniform in nature.

The Tensor product patch is defined by four corner points, tangents at the corner points in two orthogonal directions (derivatives with respect to the two parameters u and w) and twist vectors at the four corners. It is only necessary to match these vector quantities at the corner points to get zero-order and first-order continuity across surface patches.

The Bezier patch is defined with the help of a characteristic polyhedron. The vertices of this polyhedron define the tangent vectors and twist vectors at the patch boundaries. These control points can be easily manipulated to change the shape of the surface patch.

The B-spline patch is also defined with the help of a characteristic polyhedron. The control points normally do not lie on the patch. Curvature continuity can be obtained with B-spline patches. The DME should support the creation and manipulation of uniform and nonuniform B-spline surface patches.

The DME should support rational forms of the Tensor product patch, the Bezier patch and the B-spline patch. In the rational form, the surface polynomials are defined as a

ratio of two polynomial functions. The control points for the patches have to be defined in a homogeneous coordinate system with the fourth coordinate being a weight factor associated with each control point. These weights allow greater control over the shape of the surface patch.

7.1.2 Solid Modeling

The DME should support three methods of representing solid models:

1. Constructive Solid Geometry (CSG)
2. Boundary Representation (B-Rep)
3. Sweep Representation

Constructive Solid Geometry

In the Constructive Solid Geometry (CSG) method, complex solids are defined as compositions of simpler solids. Boolean operators are used to execute the composition. CSG uses all the regularized boolean operators : union, intersection and difference.

Boundary Representation

In the Boundary Representation (B-Rep) method, solids are defined by the faces bounding the solid volume. This method allows the conversion of surface models to solid models.

Sweep Representation

Sweep representation of solids are generated by surfaces moving along some path.

7.1.3 Feature-Based Modeling

Features are denoted by descriptive words commonly used by design engineers to describe the geometry of a part (e.g., hole, boss, keyway). A set of standard features should form a part of the DME. Gandhi (1989) has compiled an exhaustive list of features used by designers. These features have been grouped into various categories based on form and topology. Parametric equations have been formulated for defining these features. CADMADE should include this extensive "dictionary" of features as modeling entities that can be used by the applications program. These features should be available as both wireframe and solid entities that can be sent to the CAD data structure.

The DME of CADMADE should also allow the creation of "super features". Super features can be compared with the "Generalized Drawing Primitive (GDP)" supported by graphics standards. The applications program should be able to define a "super feature" as a collection of features, set up the parameters for defining the super feature and then use the super feature as a regular feature. For example, a keyed shaft can be defined as a super feature made of two features, shaft and keyway. The dimensions and location of the keyway can be defined as functions of the dimensions of the shaft. Thus, defining the radius and length of the shaft would automatically size and locate the keyway. An implementation of the DME could contain a library of some commonly used super features; e.g., springs, fasteners, etc.

7.2 Modeling Operators

Modeling operators should allow certain operations to be performed on geometric entities in the CAD data structure in order to modify or reshape the entities.

Boolean Operators

Boolean operators allow the modification of solids in the CAD data structure. All the regular Boolean operations should be supported by the DME.

Alignment Operators

The alignment operator will allow the applications program to easily align various parts in the CAD data structure prior to assembly or other operations. The alignment operator requires a knowledge base of alignment parameters for the features in the DME library. For example, invoking a function to align the axis of a shaft with axis of a hole should align the shaft with the hole, as shown in Fig. 19. The alignment operator will greatly reduce the calculations that would normally need to be performed by the applications program.

Attachment Operators

The attachment operator will allow the applications program to attach various parts of a geometric model to each other. Two different types of attachment operators have been defined for CADMADE:

1. Assembly
2. Integral

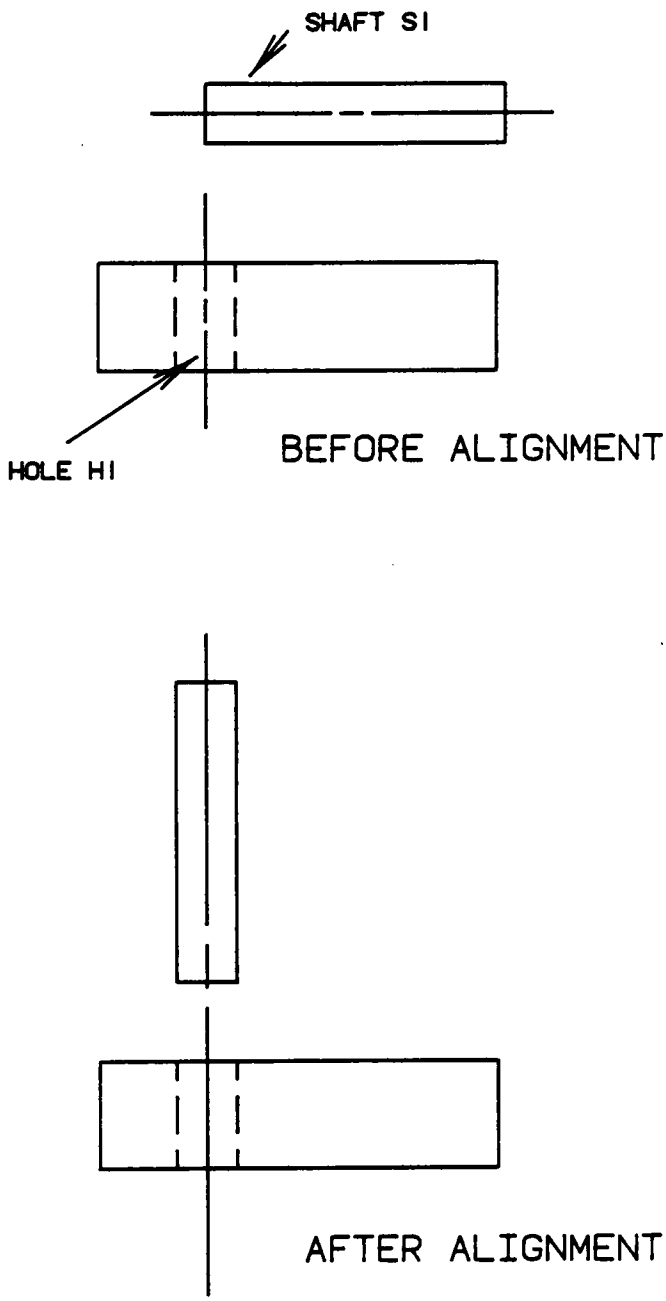


Figure 19. Example of the Alignment Operator

The concept of the assembly operator is well developed and is supported by a number of commercial CAD/CAM systems. The integral attachment operator simulates physical attachment which is often encountered; e.g., welding, glueing, collection of primitives machined from the same piece of material, etc. In an assembly attachment, the two parts being assembled retain their individual identities and a change made to one part (e.g., location change) does not effect the other. In Boolean operations, the solids being joined together lose their individual identities and become one solid. The integral attachment operator should allow the attached parts to retain their individual identities while behaving as one part. The attachment operator should also support tolerancing specifications for the objects being attached.

Reshaping Operators

The reshaping operator should allow an object to be reshaped using deformation equations. Examples of reshaping operators are bending, stretching, twisting, etc. This operator is meant to allow design engineers to deform various parts to suit specific needs of the design as is often done in the workshop (e.g., coiling a wire to form a spring).

7.3 Analysis and Query

The Analysis and Query system of the DME should allow the applications program to analyze objects/parts for various properties of the model and extract information about the model from the CAD data structure. The various analysis and query capabilities of an applications program using DME should be:

1. **Property Analysis :** The applications program should be able to analyze a solid object in the CAD data structure for mass properties and material properties.
2. **Interference Analysis :** Interference analysis is often very important in CAD systems for final design of assemblies. The applications program should be able to determine the interferences in an assembly in the CAD data structure. The tolerancing in the assembly should also be obtainable from the CAD data structure.
3. **Queries on Surfaces and Curves :** The applications program should be able to make queries on surfaces and curves and obtain information pertaining to the entities (e.g., curvature, tangent, entity type, etc.).
4. **Queries on Solids :** Applications programs should be able to perform queries on the solids in the CAD data structure. Examples of such queries are: intersections between solids, union of solids, etc.
5. **Queries on Features :** A number of queries should be available for the features supported by the feature-based modeler. The applications program should be able to query a feature to determine the parameters that are required to define the feature, names (character strings) which describe the parameters and the system defaults for the parameter ratios. For example, a query on "shaft" would return the two parameters "radius" and "length" and the default value for the radius to length ratio. This information could be used by the applications programmer in setting up a template for the user interface for designing with features. The applications programmer does not need to have knowledge of all the features she/he uses from the DME library.

   Other inquiries on features would enable the applications programmer to fabricate the feature, other features with a similar topology and other features with similar functions.

7.4 Logical Modeling Input/Output Devices

The concept of logical input devices is well developed and is supported by graphics standards (GKS and PHIGS). A similar concept has been developed for the DME to facilitate user interactions with geometric models created by CAD/CAM applications programs during a modeling/design cycle. Logical modeling input/output devices will provide the applications program user with a very versatile and realistic environment for model building.

The Six-Degree-of-Freedom Input Device

The location and orientation of any three-dimensional object requires the specification of six values in spatial coordinates. A logical six-degree-of-freedom input device in the DME will allow the applications program to use the device on various workstations which support different physical input devices without having to modify the applications program. For example, one workstation might use six dials for the six-degree-of-freedom input device whereas another might use a six-degree-of-freedom mouse similar to the one described by Ware and Jessome (1988). This logical input device could be used for orienting and locating objects in the three-dimensional model.

The Logical Gripper

The logical gripper is a logical input device which can be used to grip objects and move them in three-dimensional space. For example, a logical gripper could be used in conjunction with a six-degree-of-freedom input device to move in three-dimensional

space, grip an object and manipulate it. This kind of input would provide a much better user interface than would the use of valuators (or dials) to orient an object.

The Logical Feel Device

CAD/CAM systems have always used visual devices as the main output devices. However, when a designer/engineer builds a prototype in real life, feel as well as sight contribute to the design evaluation process. The concept of "Data-Glove" has demonstrated the feasibility of devices which allow human beings to feel objects which exist only in computer memory. A logical feel device has been included for this purpose in the DME. The logical feel device should greatly enhance the design feedback to the applications program user, especially if it is coupled with the grip and six-degree-of-freedom input devices to allow the user to grip and feel the object while manipulating it.

7.5 Other Features of the DME

Modeling Utility Procedures

The development of geometric modeling applications usually requires the support of a number of commonly used procedures which should be included as "utilities" in the DME. For example, most CAD/CAM applications programmers require the use of a number of vector and matrix functions (e.g., dot product, cross product, etc.), some

interpolation procedures and other mathematical operations. The utilities in the DME should include:

1. Vector Manipulation Functions
2. Matrix Manipulation Functions
3. Interpolation Procedures
4. Curve and Surface Utilities
5. Coordinate Transformations and other Transformation Utilities

The Equation Solver - Parametric Geometry

Equation solvers and algebraic processors are sometimes of great assistance to CAD applications programmers. This facility in the DME should allow applications programs to attach equations to models for the automatic resizing of the various interrelated dimensions of the parts when some of the dimensions are changed. This should greatly enhance the creation of CAD systems which incorporate parametric geometry techniques.

Design Evaluation

An effective CAD/CAM system offers design evaluation features to its end users. The DME should support the creation of design evaluation software by maintaining a library of commonly used design equations and rules of thumb. Some of the basic design/strength analysis equations (e.g., beam bending, spring design, shaft twisting, etc.) should be included in the DME. The DME should provide interfaces for finite element analysis systems, optimization procedures and other evaluation systems.

7.6 The CAD Data Structure

Most CAD applications use a hierarchical data structure to store and organize models. A data structure that would facilitate the development of mechanical design applications has been designed for CADMADE. The modeling entities are stored in a hierarchical manner in the data structure. The model of an assembly can be broken down into a number of lower level entities which form the different levels of the hierarchy. Figure 20 shows the hierarchical arrangement of entities in the data structure. The entities are:

1. Primitives (curves, surfaces and solids)
2. Features and Super Features
3. Objects
4. Parts
5. Assembly
6. Instance

A feature is modeled with the help of surface and solid primitives which form the lowest level of the hierarchy. The concept of super features has been discussed earlier in this chapter. A number of features can be grouped to form an object. Features cannot be "assembled" to form an object; they have to be "integrally attached" or Boolean operations must be performed on the features being grouped to form an object. Different objects can be grouped (assembled or integrally attached) to form parts which can be assembled (not integrally attached) to form an assembly.

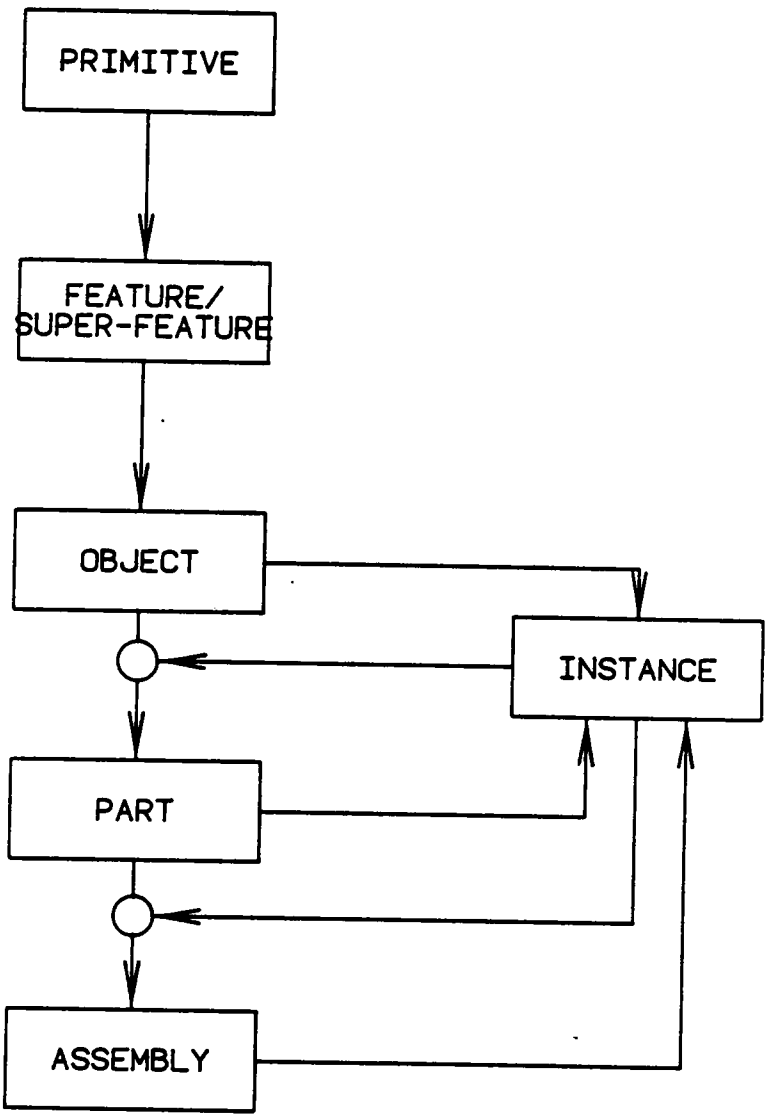


Figure 20. The CAD Data Structure Hierarchy

The concept of "instancing" can be used in the CAD data structure. An object, part or assembly can be used as an instance and used in other parts or assemblies. Recursive instancing should not be supported.

The locations of assembled objects and parts can be stored in a parametric form in the "parent". The locations can be specified as functions of various dimensions to allow automatic relocation during redesign. The CAD data structure should also allow the applications program to define attributes for the model.

Every object, part and assembly should have a name and a number associated with it. These identifiers can be defined by the applications program during definition of the model and can be used at a later stage for analysis, inquiry or modification procedures. Constraints can be attached to each entity in the data structure. An example of a constraint is the maximum number of times an object can be instanced. This limits the end user to work within certain limitations imposed on her/him by the applications program.

Entities can be grouped by their names and/or instance numbers and constraints and other attributes can be applied to these groups.

7.6.1 Data Structure Operations

A number of operations can be performed on the CAD data structure by the applications program.

1. DEFINE - The "define" function should allow the program to begin defining an object, part or assembly.

2. ADD TO - This function should allow the applications program to add entities to an existing object, part or assembly.
3. INSTANCE - The "instance" function should allow the program to use instances of an object, part or assembly and add it to another part or assembly.
4. DELETE - This function should allow the program to delete an object, part or assembly.
5. DELETE ALL - This function should allow the program to delete all instances of an object, part or assembly.
6. COPY - This function should allow the program to copy an object, part or assembly with a new name and number.
7. MODIFY - This functions should allow selective deletion of features in an object, objects in a part or parts in an assembly.
8. UNDO - This function should allow the last entry in the data structure to be deleted.

7.6.2 Difference Between Primitives in PHIGS+ and the DME

PHIGS+ allows the creation of a number of curves and surfaces. Parametric polynomial and nonuniform B-spline curves and surfaces can be inserted into PHIGS+ data structures as primitives. However, the curves and surfaces in PHIGS+ are stored in the data structure only for display purposes.

The curves and surfaces in the DME CAD data structure will be stored as complete geometric models. These models can be analyzed and can be modified by the applications program. These entities can also be used to create higher level entities (e.g., solids and features). Moreover, PHIGS+ only supports curves and surfaces, whereas CADMADE will include solids and features as entities in the data structure.

8. The Expert Consultation Environment and the Knowledge Database

The Expert Consultation Environment (ECE) should allow the applications programmers to develop custom expert systems to support their CAD/CAM applications program. These expert systems can be created with the help of high-level procedures and functions. Using the ECE, the applications programmer should not have to spend time developing some of the basic features of expert systems; e.g., inference engines, forward and backward chaining techniques, etc. Instead, the applications program can define the objects or parameters which are to be analyzed by the expert system, define rules in an English-like manner and invoke the expert system, called the *"Expert Technician"*.

8.1 The Knowledge Base and the Inference Engine

The Expert Technician (ET) consists of two parts : the Knowledge Base and the inference engine. The inference engine is the reasoning and problem-solving method manager. The inference engine should contain strategies used to solve problems and acquire knowledge. The ECE should support two types of inference engines:

1. Backward chaining
2. Forward chaining

In backward chaining the inference engine is goal driven and works backward from the goal to determine supporting data. In forward chaining, the solution is constructed from the knowledge in the Knowledge Base.

The Knowledge Base is a repository of information made up of factual knowledge (e.g., of material properties and manufacturing processes) and heuristic knowledge (e.g., rules of thumb). This knowledge could consist of facts about the subject, definitions, formal rules, rules of thumb, or rules of good guessing, and truly represents the expertise of the expert.

The Knowledge Base of CADMADE should be constructed from two types of objects:

1. Parameters
2. Rules

The applications programmer can specify the parameters for the Knowledge Base using the Knowledge Base Manager. Parameters can have constraints and an indication of whether the value of the parameter is to be obtained from the applications program user, the default value in the Knowledge Base or the processing of rules. Rules establish relationships between parameters. Rules can be sent to the Knowledge Base using an English-like syntax.

8.2 Modes of Interaction with the Expert Technician

The ECE has been designed to closely approximate the way an expert is consulted by a designer/engineer. The applications program has the flexibility to decide on the applications program--ET interaction and the applications program user--ET interaction methods. The applications program can use the User Interface Environment of CADMADE to allow the end user to interact with the ET. A dialog area can be attached to each Expert Technician and the user can interact with one ET at a time or with all of them through one dialog area.

Five different modes of interaction have been identified for inclusion in the ECE :

1. Transaction Mode
2. Dialog Mode
3. Observer Mode
4. Teach Mode
5. Learn Mode

Transaction Mode

In the *Transaction* mode the ET should reply once to every query from the applications program. Thus, it is a one query, one reply mode. The query could come from the applications program or directly from the applications program user through the dialog areas supported by the User Interface Environment. In the transaction mode, there will be one output from the applications program to the ET and one input from the ET to the program.

Dialog Mode

The *Dialog* mode is a multiple query, multiple reply mode in which the ET may answer one query with multiple replies, multiple queries with one reply or multiple queries with multiple replies.

Observer Mode

In the *Observer* mode, the ET should act as a person observing the design process and interrupt the designer with suggestions and warnings whenever necessary. Thus, when the ET is in observer mode, there will be continuous output of information from the applications program to the expert system and occasional input to the applications program from the ET.

This mode of interaction can be compared with the "event mode" input supported by GKS and PHIGS in which the user triggers an interrupt. In the observer mode, the ET triggers an interrupt based on rules in the Knowledge Base.

Teach Mode

The *teach* mode can be used by the applications program to "teach" the ET. The applications program user acts as a teacher and sends information/ knowledge to the ET and the Knowledge Base.

Learn Mode

The *learn* mode differs from the teach mode in the sense that the ET selectively adds knowledge to the Knowledge Base. In the learn mode, the ET should continuously observe the output to the expert system from the applications program and selectively add important information to the Knowledge Base.

The modes of interaction described above can be compared with the modes of interaction allowed for the input devices supported by PHIGS. A major difference between the two is that the ET should be able to operate in more than one mode at any given time.

9. A Prototype of the UIE

A prototype of the User Interface Environment was created on an IBM VM/CMS system. The routines were coded in FORTRAN. PHIGS was used for graphics support.

9.1 The Menu/Icon System

The routines to support the creation of menu structures were written. The menu structures are stored in a file which acts as a part of the UIE data structure. Only the Menu Text Primitives (both Title and Item) are supported in this prototype. The support routines for Menu Title Icons and Menu Item Icons only store the Icon data in the data structure. The display of Icons is not supported. All attributes of the Menu primitives (except Icons) are supported in this prototype implementation. Attribute hierarchy is achieved by pushing attributes on to a stack when an "execute submenu"

function is encountered. Only individual specifications of menu locations is possible in the prototype UIE. Menu structure editing and global menus are not supported.

Use of PHIGS for the Menu Interface

The menu data are stored in a file on the VM/CMS system. When the "CRMNRT" (CReate MeNu RooT) function is invoked, the PHIGS structures used to display the menus are created. PHIGS structures 10000 to 90000 are used for root structures posted to the workstation and structures 1000 to 9999 are used for displaying menus. The name set 126 is used for invisible menus and 127 is used for visible menus. The menus are displayed using view 0 and the Normalized Device Coordinates used range from -1.0 to 1.0 in the X and Y directions.

The PHIGS pick input device is used for menu pick. The pick path is checked to find the structure containing the picked element. If it is a menu structure, a menu pick is returned along with the menu pick path. A menu identifier of -1 indicates a return and a menu identifier 0 indicates a root menu. Defaults are defined for menu attributes and locations. A new input device class has been defined for menu pick. In the event mode of input, a menu pick event has a class value of 7.

9.2 The User Communication Interface

The prototype of the UIE includes support software for defining and using one dialog area. Most of the attributes related to dialog areas can be used by applications

programs using the prototype UIE. Messages can be sent to this dialog area using a CADMADE message utility. A string input device (keyboard) is attached to the dialog area. The character "$" signifies a system command for the string input. Any string input starting with a "$" is treated as a CMS command and executed using the VM/CMS "SYSCAL" function. The string input for menu selection, dialog buffer and dialog overwrite mode are not supported in the prototype UIE.

9.3 The CAD View Manager

One function in the prototype UIE allows the applications program to automatically apply viewing transformations to a view by using valuators. The seven view transformations (X, Y, Z rotations, X, Y, Z translations and scaling) are mapped to seven valuator input devices.

9.4 Testing the Prototype UIE

An applications program was written to test the various features of the menu system and the user communication interface of the prototype UIE. The menu hierarchy shown in Fig. 21 was used to create the menu structures in the UIE. This hierarchy also tested the capability of the UIE to allow the same menu structure to be invoked in different

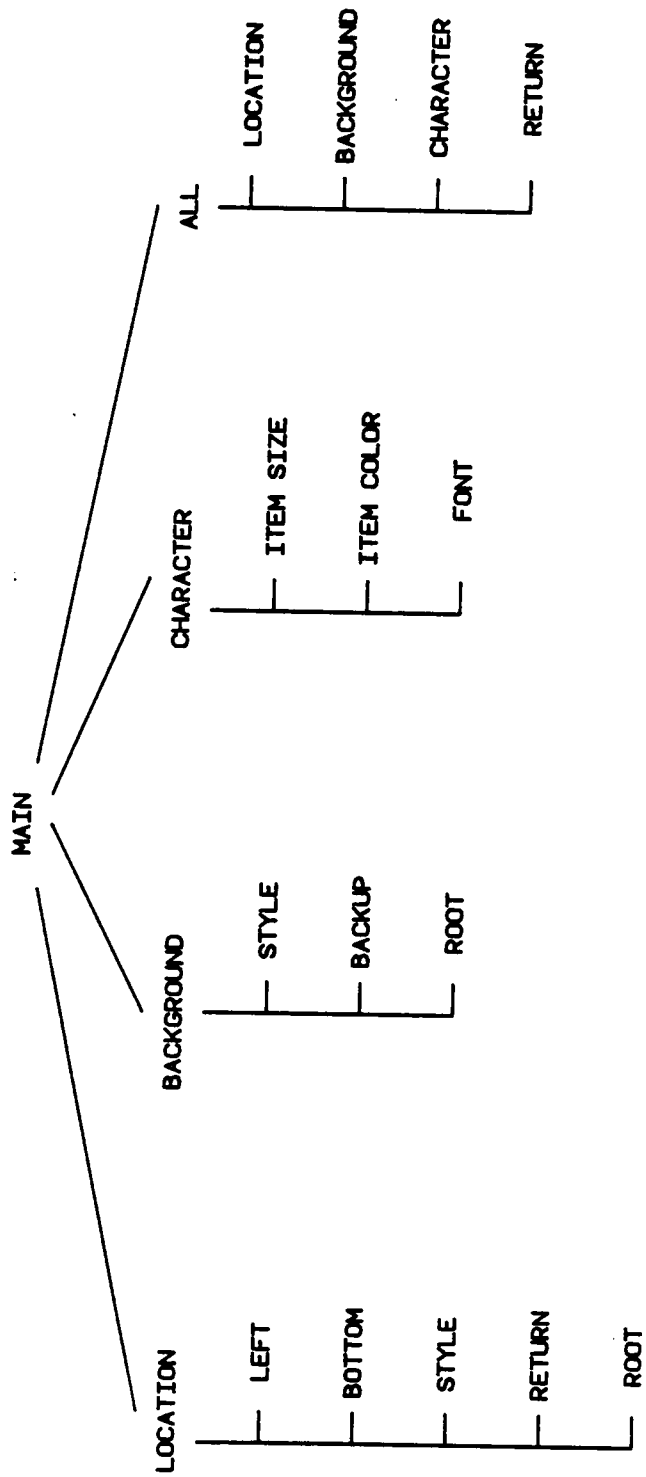


Figure 21. Menu Tree Used to Test the Prototype UIE

levels in the tree. Menu structures were created for the nodes of the menu tree using the UIE.

Figure 22 shows the root menu with default UIE attributes and locations. In the menu structure "MAIN", attributes were not set for the menu primitives. The system default attributes and the default location parameters were used by the UIE to display this menu screen. In the menu structure "CHARACTER" different colors and sizes have been used for the menu title and the menu items. Figure 23 shows these text attributes. An example of different background attributes is shown in Fig. 24. In this menu structure, the locations of the menu items were modified and the background fill area vertices, fill area styles and outline line types were also changed. Figures 25 and 26 also demonstrate the capability of the applications program to modify menu locations. In all these figures, the message in the dialog area is generated automatically by the UIE from the "Menu Prompt" attribute of the menu structure.

9.5 A Sample CAD Applications Program Using CADMADE

A sample CAD applications program was created using the prototype UIE and the prototype feature-based modeler created by Gandhi (1989). This applications program allows the user to step through a hierarchical menu tree and design parts using some basic features supported by the feature based modelers.

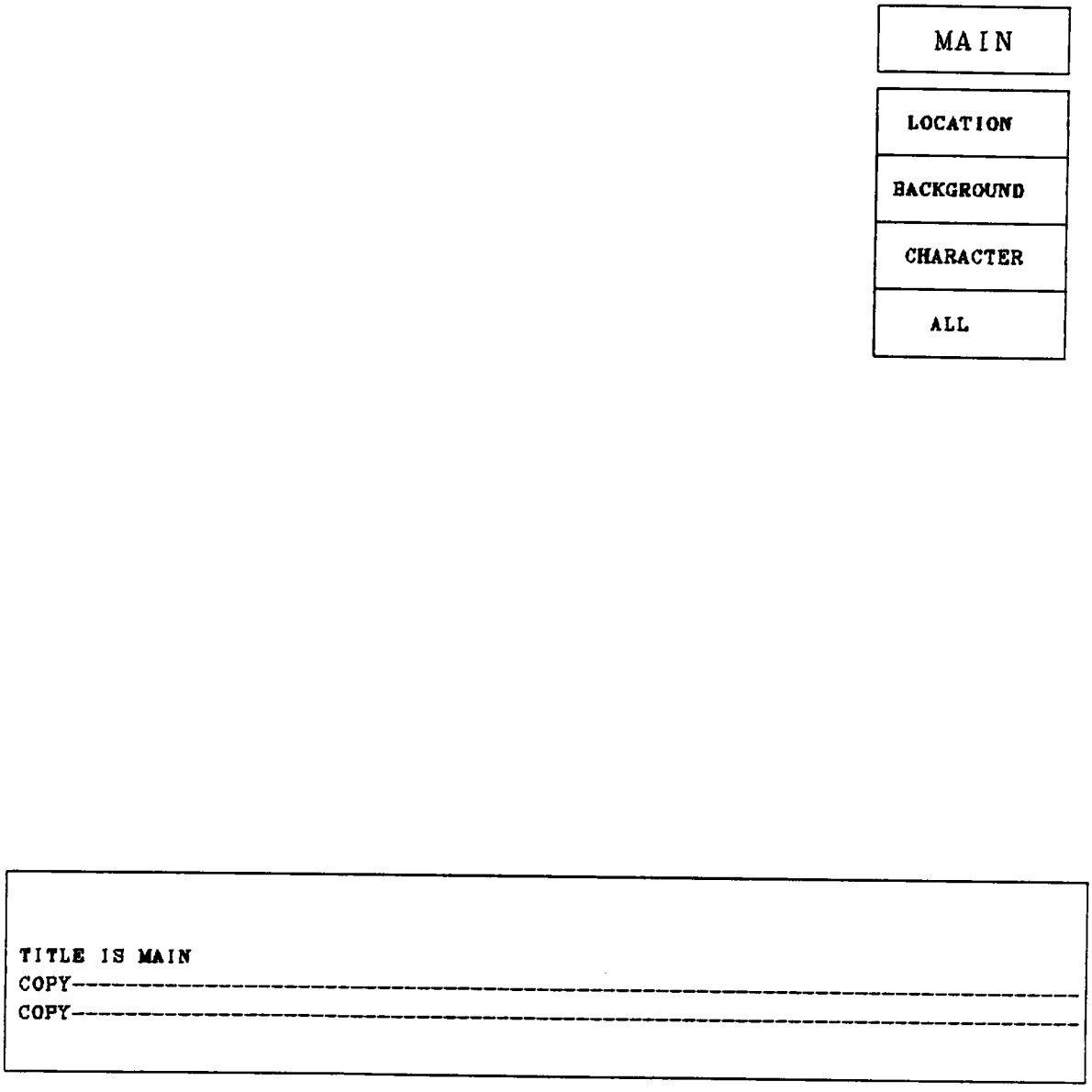
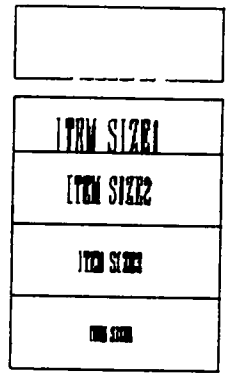
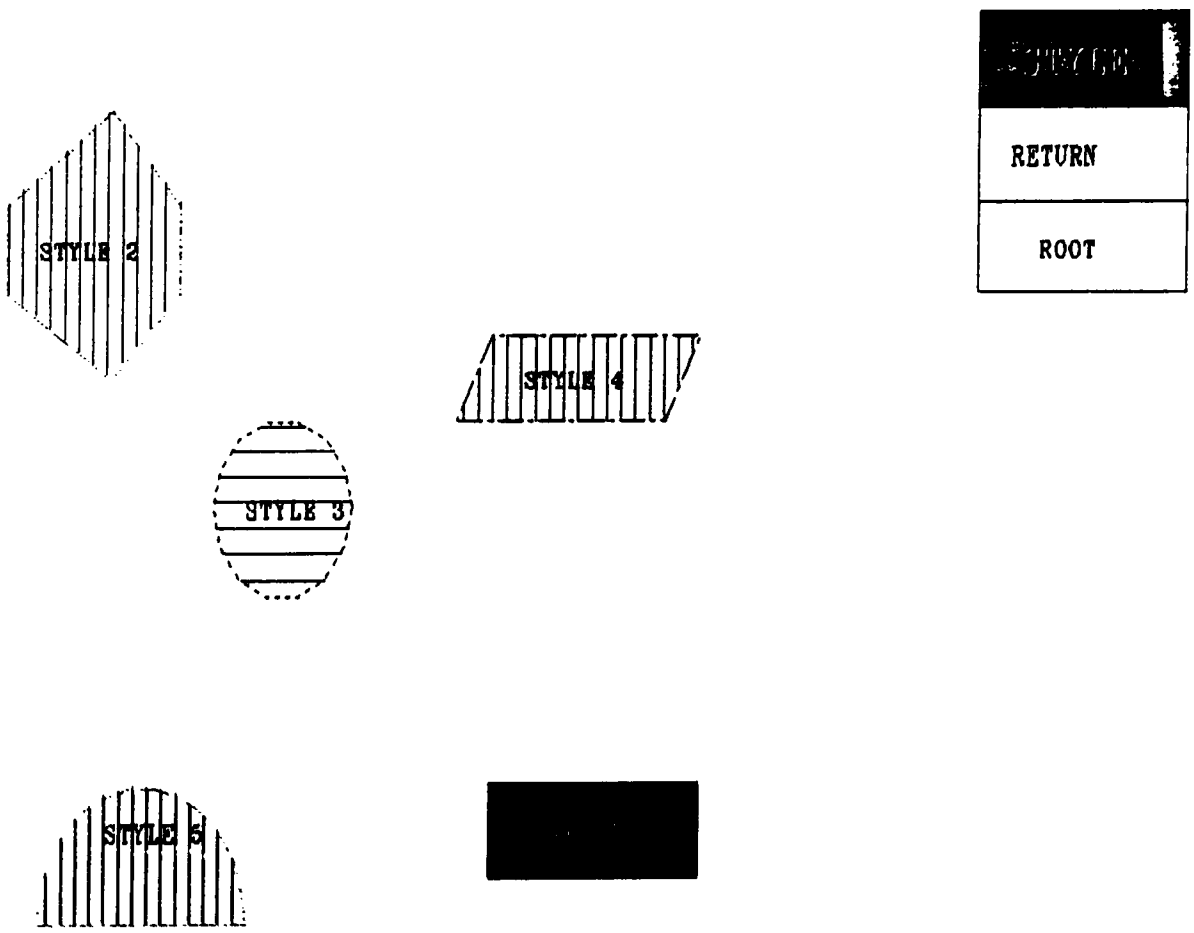


Figure 22. Root Menu Screen of Test Program



```
TITLE IS BOTTOM
COPY-------------------------------------------------------------------------
TITLE IS MAIN
TITLE IS CHARACTER
COPY-------------------------------------------------------------------------
```

Figure 23. Example of Text Attributes of Menus




```
COPY-------------------------------------------------------------------------
TITLE IS MAIN
TITLE IS BACKGROUND
TITLE IS STYLE
COPY-------------------------------------------------------------------------
```

Figure 24. Example of Background Attributes of Menus

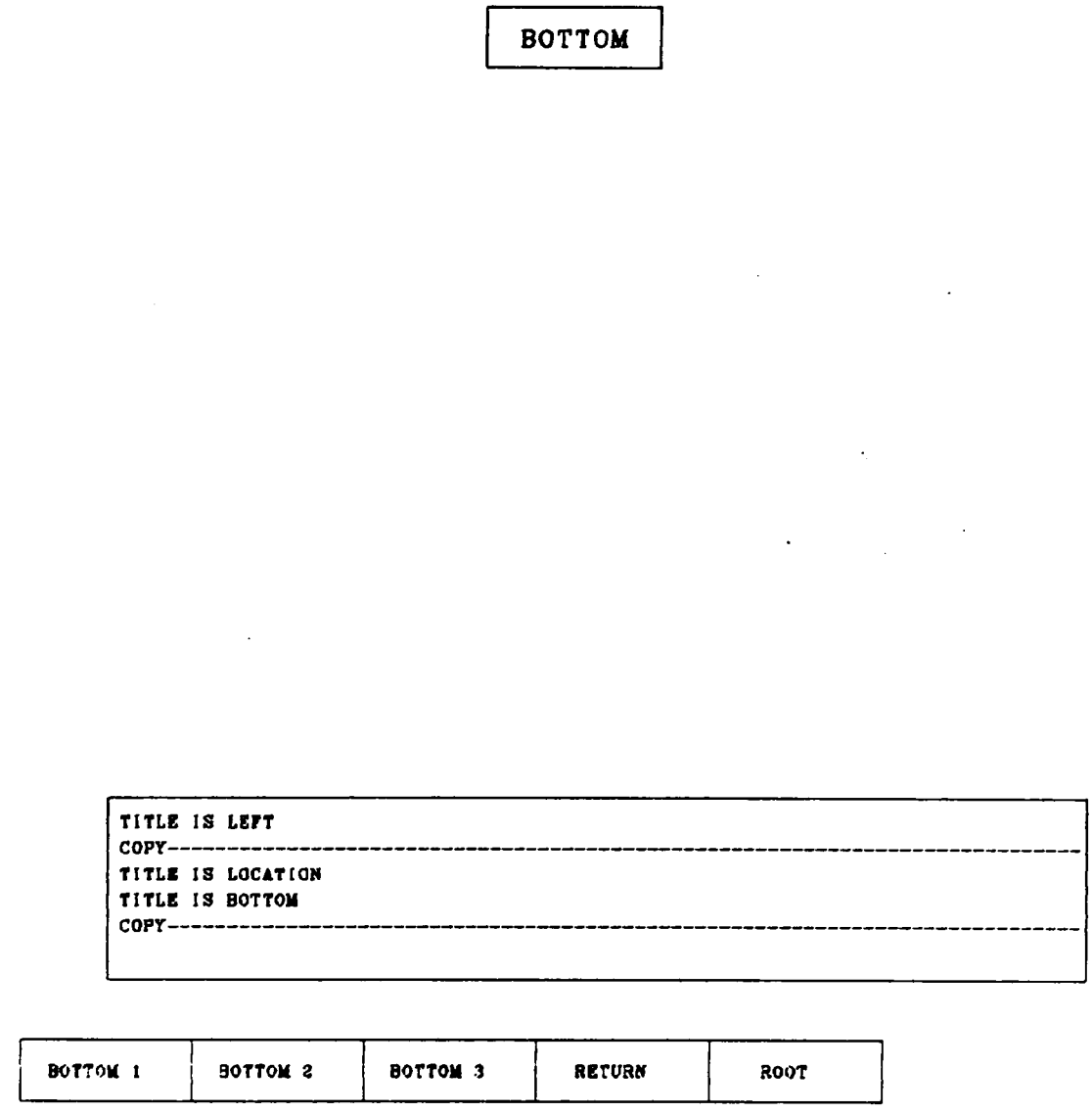
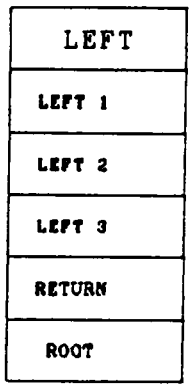


Figure 25. Menu Location - Example 1




```
COPY----------------------------------------------------------------------
COPY----------------------------------------------------------------------
TITLE IS LOCATION
TITLE IS LEFT
COPY----------------------------------------------------------------------
```

Figure 26. Menu Location - Example 2

Two menu trees were used for this CAD applications program. The first tree, "SHAPES", was created to allow the user to define the generic shape of the feature and then create a specific feature by selecting the feature from the menu (Fig. 27). The second menu tree, "UTILITIES" allows the user to access a deleting facility provided by the program to delete the entire object or just a feature of the object being designed (Fig. 28). Figures 29 and 30 show examples of the menu screens for the CAD applications program.

The sequence of processes invoked by the applications program to implement the menu system and the feature-based modeler is:

1. Open PHIGS
2. Open Workstation
3. Initialize Workstation (colors, input devices, etc.)
4. Open the UIE
5. Create Menu Structures
6. Open the DME
7. Initialize the Feature-Based Modeler
8. Create Menu Root for SHAPES menu tree
9. Create Menu Root for UTILITIES menu tree
10. Post SHAPES menu tree
11. Post UTILITIES menu tree
12. CADMADE Await Event
13. If a menu pick is encountered, process the menu pick: either call "Next Menu" to display the next menu screen or create or delete features after further user input.

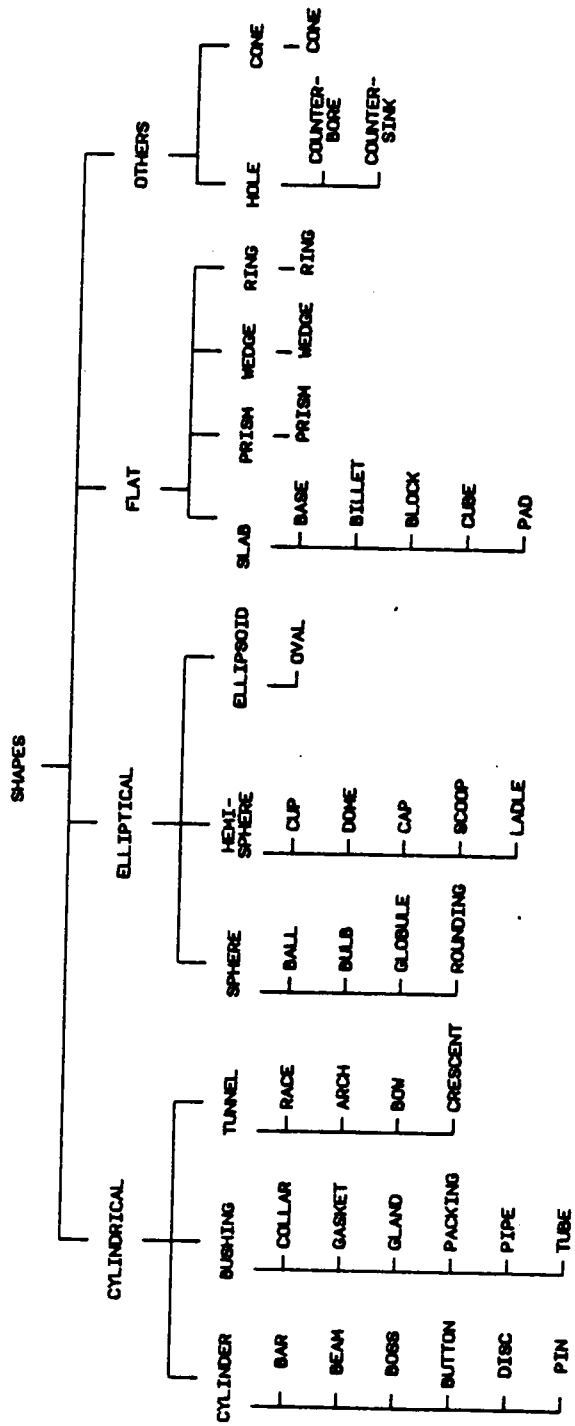


Figure 27. "SHAPES" Menu Tree for Sample CAD Program

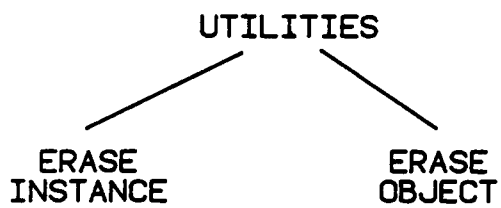


Figure 28. "UTILITIES" Menu Tree for Sample CAD Program

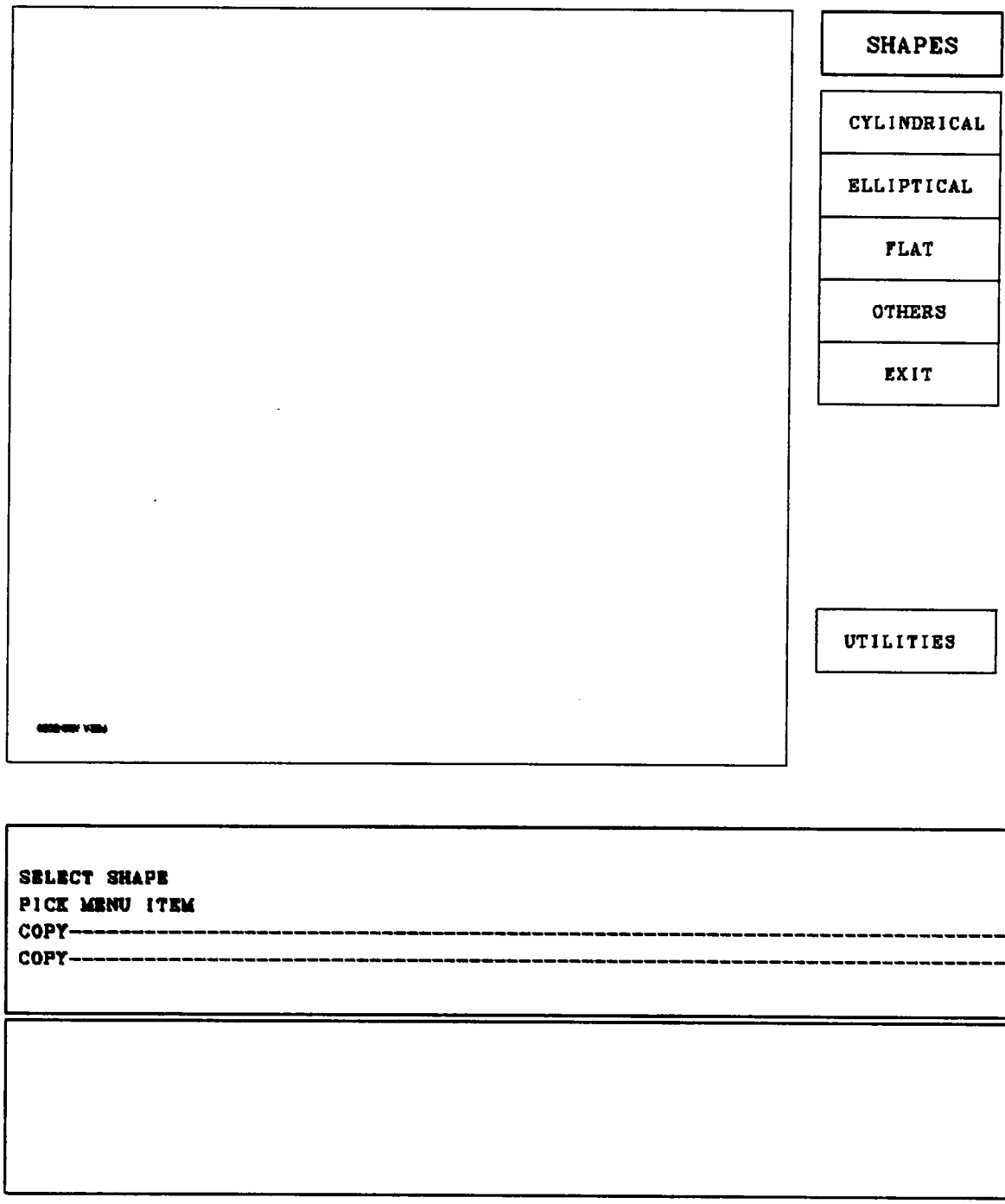


Figure 29. Menu Screen of Sample CAD Program - Example 1

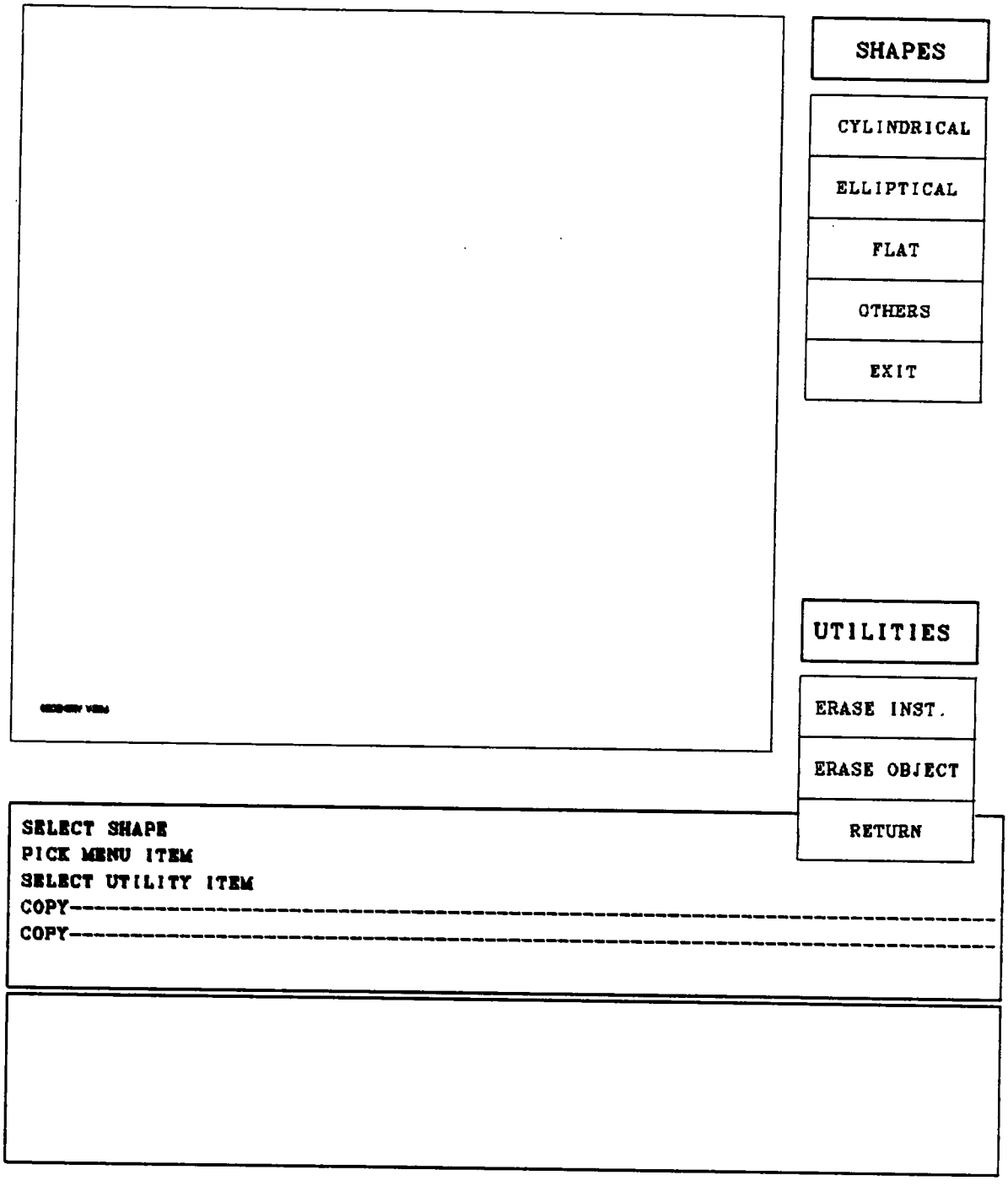


Figure 30. Menu Screen of Sample CAD Program - Example 2

The last step in the process listed above would have been the most complicated programming task in the absence of the UIE and the feature-based modeler. The UIE allows the applications program to automatically display the correct menu with the menu prompt when a menu item is picked with just one FORTRAN subroutine invocation. If the menu picked is at the lowest level of the "SHAPES" tree, the applications program has to invoke only one FORTRAN subroutine of the feature-based modeler to display an input template for the correct feature and create the feature. Seven valuators are initialized by the CAD program and the prototype UIE automatically applies viewing transformations to the geometry view when any valuator is used.

Figures 31 and 32 show models which were created using this sample CAD applications program.

9.6 Conclusions

The implementation of the prototype UIE consisted of approximately 10 000 lines of documented FORTRAN code. The feature-based modeler consisted of 12 000 lines of FORTRAN code. The sample CAD application was coded using 2300 lines of documented FORTRAN code. Thus, the CAD applications program had 22 000 lines of program supporting it.

Setting up menus for this application was an extremely simple programming task. In the absence of the UIE, a method for storing and displaying menus would have had to be

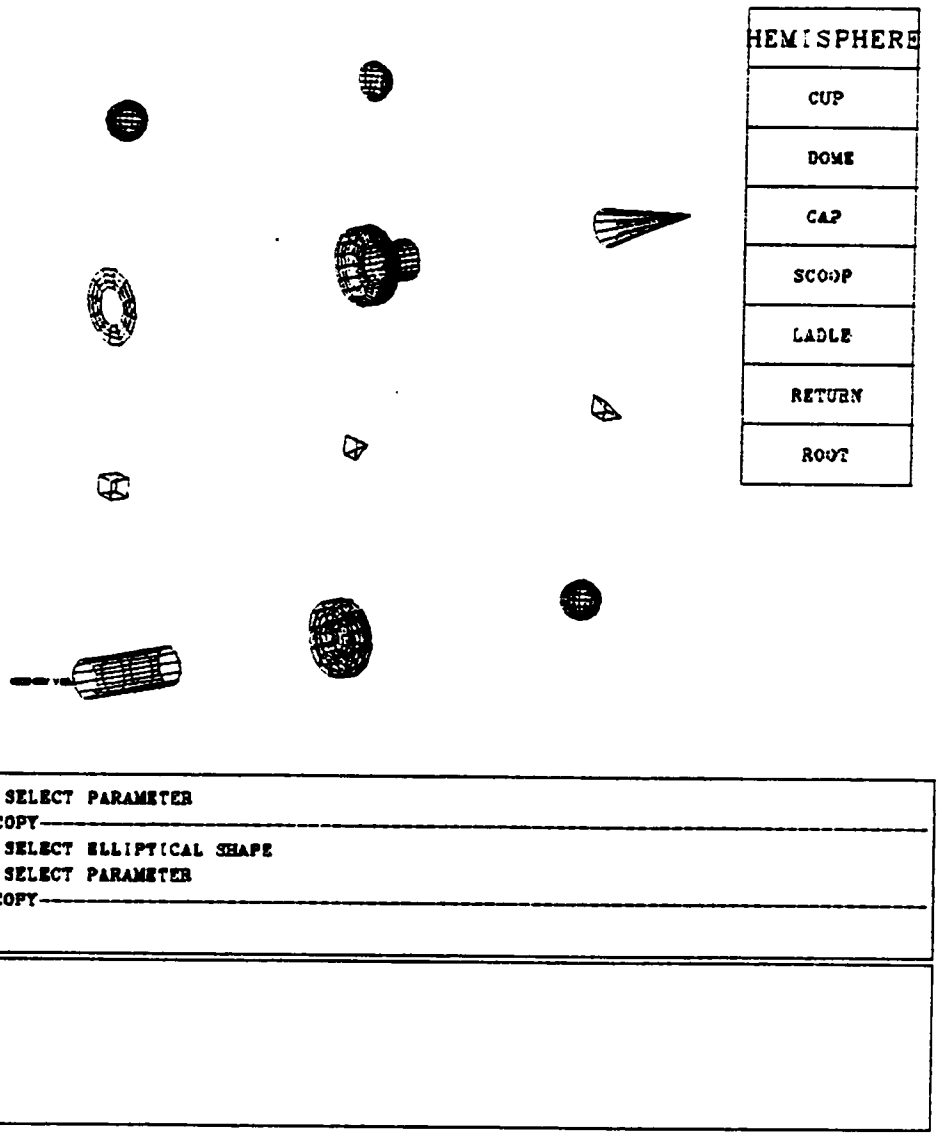


Figure 31. Model Created using the Sample CAD Program - Example 1

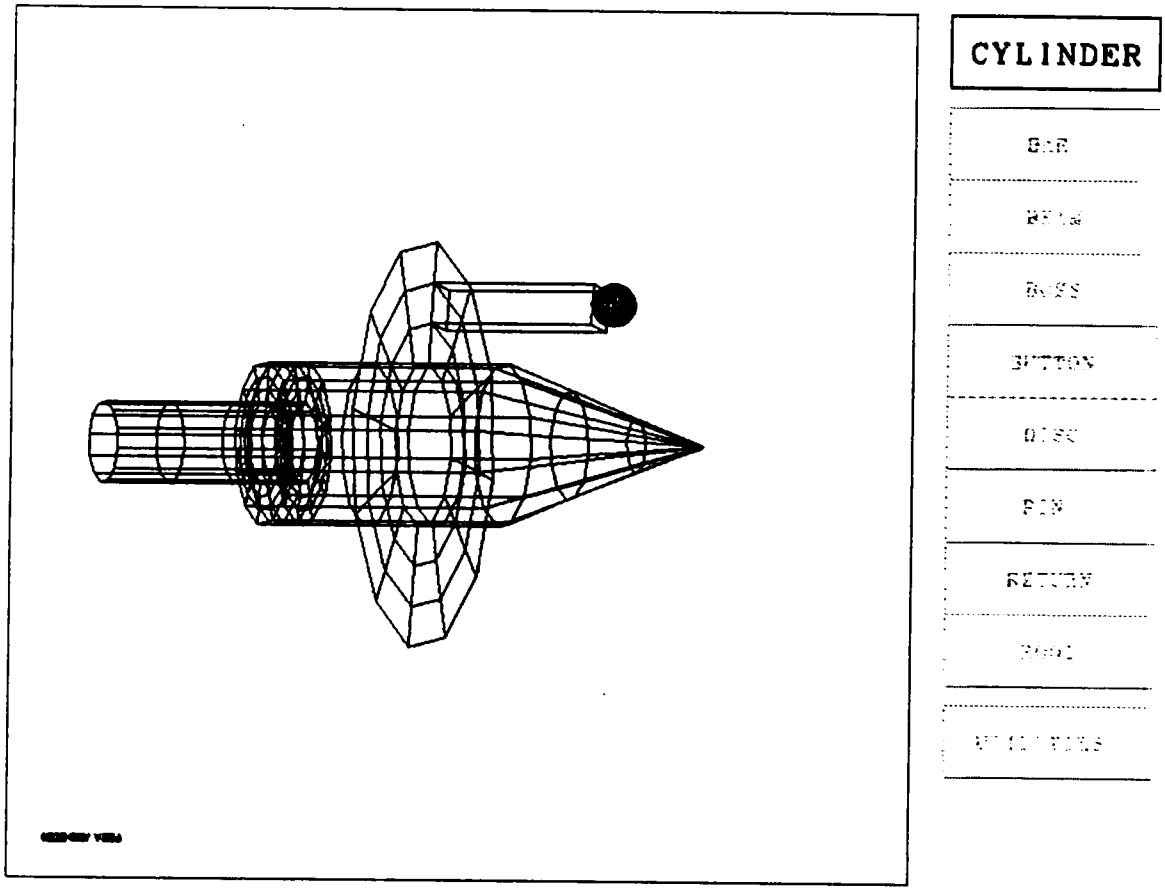


Figure 32. Model Created using the Sample CAD Program - Example 2

designed. FORTRAN code would have had to be written for displaying the menus, setting pick identifiers for the menus, making previous menus invisible and current menus visible, displaying prompts, setting up a dialog area, scrolling messages, displaying new messages, and various other similar functions. All these functions would have had to be programmed using PHIGS.

Because of the high-level functions provided by the UIE, this sample CAD program only had to define the character strings for the menu items in the menu structures, invoke submenus from within the menu structures, and post the root menus. The dialog area was automatically created by the prototype UIE and prompts for menus were automatically sent to the dialog area. The CAD program did not have to scroll the messages every time a message was sent to the dialog area. The use of valuators for viewing transformations was also greatly simplified by the prototype UIE.

The feature-based modeler was used as a prototype of a portion of the DME. The feature-based modeler was used without having to learn about the various features involved. A default template supplied by the feature-based modeler was used for user input. In the absence of the feature-based modeler, the CAD programmer would have had to create a vast database of the various features, the parameters required to create the features and default values of the parameter ratios. Code would have had to be written to find the appropriate parameters for the feature selected by the user, use PHIGS to create a template, associate the PHIGS template structure with a view, account for the user interactions with the template, create surface patches to model the feature, generate PHIGS structures to display the model, draw lines in the PHIGS structures to display the patches, associate the structures with a view and post the PHIGS structure to the workstation. This sequence of functions was achieved by the

sample CAD program by invoking only ***one*** FORTRAN subroutine in the prototype feature-based modeler.

Thus, the creation of this sample CAD applications program was achieved with considerable ease because of the availability of high-level functions for creating the user interface and generating geometric models.

10. Summary and Recommendations

10.1 Summary

In this dissertation, an approach towards the establishment of a CAD/CAM programming standard has been presented. This programming environment is called CADMADE - Computer-Aided Design and Manufacturing Applications Development Environment. CADMADE includes not only graphics programming support, but also high-level procedures to support the creation of geometric modeling, mechanical design, manufacturing, expert systems and user interface software. CADMADE consists of five programming environments and two database managers. The programming environments are:

1. The User Interface Environment (UIE)--User Interface data structure
2. PHIGS + --PHIGS + data structure
3. The Design and Modeling Environment (DME)--CAD data structure and Product Information data structure

4. The Virtual Manufacturing Environment (VME)--CAM data structure and Product Information data structure
5. The Expert Consultation Environment (ECE)

The database managers are :

1. Universal Database Manager (UDM)--Universal Database
2. Knowledge Base Manager (KBM)--Knowledge Base

The User Interface Environment (UIE) was designed in great detail. Various aspects of user--applications program interaction were addressed. A data structure for storing the UIE data was created. Higher level procedures to facilitate viewing operations for CAD/CAM applications were designed. Suggested FORTRAN bindings were created for the functions supported by the UIE and for some control functions of CADMADE.

The Design and Modeling Environment (DME) was designed. The requirements of the CAD data structure which supports the DME were created. A new concept in logical input/output devices for the DME was introduced. These logical modeling input/output devices facilitate user interactions with geometric models created by CAD/CAM applications. The functional requirements of some of these logical modeling input/output devices were created.

The requirements for the Expert Consulatation Environment (ECE) and the Knowledge Base were created. A new concept in the modes of interaction between expert systems and the applications program and applications program user was created. These modes were modeled after the input device interaction modes supported by graphics standards.

A prototype of the User Interface Environment was created based on PHIGS. This prototype supports most of the functions specified in the UIE. Example results of output from this prototype UIE were presented. A sample CAD applications program was created using the prototype UIE and a prototype feature-based modeler created by Gandhi (1989). The advantages of using higher level programming environments were discussed based on the sample CAD applications program.

10.2 Recommendations

The following is a list of suggested areas of research to further the concept of machine-independent and device-independent CAD/CAM programming interfaces similar to CADMADE.

1. **The Virtual Manufacturing Environment**

   The Virtual Manufacturing Environment (VME), the CAM data structure and the Product Information data structure are some very important features of CADMADE which were not designed in this dissertation. These features have to be designed with great care and implemented in a device-independent manner to allow an implementation of CADMADE to be complete.

2. **The Expert Consultation Environment**

The Expert Consultation Environment and the Knowledge Base need to be designed in detail before bindings can be established to allow the ECE to be supported in implementations of CADMADE. Some other features of expert systems and artificial intelligence which need to be included in the ECE are natural language processing and uncertainty reasoning.

3. **Logical Modeling Input/Output Devices**

The concept of logical modeling input/output devices has been introduced for the first time in CADMADE. Further research is necessary in this field to include devices other than the ones described in this dissertation. An example is a "deformation" device which would allow the user to grip a model and deform it with her/his fingers.

4. **Feature Recognition**

CADMADE has been designed to allow feature-based design. Feature recognition is a useful implement which often facilitates the integration of CAD and CAM. Feature recognition should be included in the DME.

5. **The Design and Modeling Environment Bindings**

Language bindings have to be designed in order to allow the DME to be included in an implementation of CADMADE.

6. The Universal Database

The database to be provided for the use of the applications program should be carefully designed and included in CADMADE.

7. Error Handling

Error handling is an important feature of graphics standards and error handling in CADMADE must be designed carefully for efficiency and consistency.

The use of applications programming environments similar to CADMADE will free applications programmers from the task of writing support software (e.g., graphics, geometric modeling, etc.) for their CAD/CAM applications and they can concentrate directly on developing the overall system and the technology involved. Such a collection of high-level CAD/CAM programming procedures would provide an environment for easier, faster and more correct development of CAD/CAM applications. If, in the future, such a system can be agreed upon and accepted as a standard by ANSI and ISO, CAD/CAM programmers will be able to write portable software much more rapidly than current graphics standards allow.

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Appendix A. Suggested FORTRAN Bindings for the User Interface Environment

In this appendix FORTRAN language bindings are suggested for an implementation of the UIE. Bindings for some CADMADE control functions have also been created and are included in this section.

Control Functions

Open User Interface Environment

SUBROUTINE CMOPUI (WKID, HPDNR, ERFIL, FNAME)

Input Parameters:

INTEGER WKID	workstation identifier
INTEGER HPDNR	hierarchical pick device no.
INTEGER ERFIL	error file logical unit number
CHARACTER FNAME	error file name

Description:

Open the User Interface Environment

Initialize Feature Based Modeling

SUBROUTINE CMIFBM (WKID, ASSNUM, PRTNUM, OBJNUM,
ASNAME, PRTNAM, OBNAME, UNUM, WNUM,
VIEWID, PRIORT)

Input Parameters:

INTEGER WKID	workstation identifier
INTEGER ASSNUM	assembly structure identifier
INTEGER PRTNUM	part structure identifier
INTEGER OBJNUM	object structure identifier
INTEGER UNUM	no. of u lines/surface patch

INTEGER WNUM	no. of w lines/surface patch
INTEGER VIEWID	view identifier
CHARACTER ASNAME	assembly name
CHARACTER PRTNAM	part name
CHARACTER OBNAME	object name
REAL PRIORT	model PHIGS structure priority

Description:

Initialize the Feature Based Modeler

Open Design and Modeling Environment

SUBROUTINE CMOPDM (WKID, ERFIL, FNAME)

Input Parameters:

INTEGER WKID	workstation identifier
INTEGER ERFIL	error file logical unit number
CHARACTER FNAME	name of error file

Description:

Open the Design and Modeling Environment

Output Primitive Functions

Menu/Icon Interface

Menu Title Text

SUBROUTINE CMMTTX (LENGTH, NPTBFA, XBFA, YBFA, TITLE)

Input Parameters:

INTEGER LENGTH	no. of characters in title text
INTEGER NPTBFA	no. of vertices of the background fill area
REAL XBFA(*)	x coordinate array
REAL YBFA(*)	y coordinate array
CHARACTER TITLE	text for menu title

Description:

Draw a menu title text

Menu Title Icon

SUBROUTINE CMMTIC (STRID, NPTBFA, XBFA, YBFA)

Input Parameters:

INTEGER STRID	PHIGS structure to be used as the title Icon
INTEGER NPTBFA(*)	no. of vertices for the background fill areas

REAL XBFA(*)	X coordinates array for background fill area
REAL YBFA(*)	Y coordinate array for background fill area

Description:

Draw a title Icon

Menu Item Text

SUBROUTINE CMMITX (NITEMS, LENGTH, NPBFA, XBFA, YBFA, ITEMS)

Input Parameters:

INTEGER NITEMS	no. of items
INTEGER LENGTH(*)	array having no. of characters in each item
INTEGER NPBFA(*)	no. of vertices for the background fill areas
REAL XBFA(*)	X coordinates array for background fill area
REAL YBFA(*)	Y coordinates array for background fill area
CHARACTER ITEMS(*)	array containing texts for menu items

Description:

Draw menu text items

Menu Item Icon

SUBROUTINE CMMIIC (NITEMS, STRID, NPBFA, MENUID, XBFA, YBFA)

Input Parameters:

INTEGER NITEMS	number of menu items
INTEGER STRID(*)	PHIGS structures to be used as the

	item Icons
INTEGER NPBFA(*)	no. of vertices for the background fill areas
INTEGER MENUID(*)	array of menu pick identifiers
REAL XBFA(*)	X coordinate array for background fill areas
REAL YBFA(*)	Y coordinate array for background fill areas

Description:

Draw item Icons

User Communication Interface

Send Message to Dialog Area

SUBROUTINE CMMSG (WKID, DGID, INSTR)

Input Parameters:

INTEGER WKID	workstation identifier
INTEGER DGID	dialog area identifier
CHARACTER INSTR	message string

Description:

Display a character string as a message in a specified dialog area.

Attribute Specification Functions

Menu/Icon Interface

Set Menu Title Text Path

SUBROUTINE CMMTCP (PATH)

Input Parameters:

INTEGER PATH	menu title text path
	(RIGHT, LEFT, UP, DOWN)

Description:

Set the menu title text path

Set Menu Title Character Height

SUBROUTINE CMMTCH (HEIGHT)

Input Parameters:

REAL HEIGHT	menu title character height

Description:

Set the menu title character height

Set Menu Title Character Spacing

SUBROUTINE CMMTCS (SPACE)

Input Parameters:

REAL SPACE — menu title character spacing

Description:

Set the menu title character spacing

Set Menu Title Character Expansion Factor

SUBROUTINE CMMTXP (EXPANS)

Input Parameters:

REAL EXPANS — menu title character expansion factor

Description:

Set the menu title character expansion factor

Set Menu Title Text Alignment

SUBROUTINE CMMTAL (HORIZ, VERT)

Input Parameters:

REAL HORIZ — menu title text alignment horizontal (NORMAL, LEFT, CENTER, RIGHT)

REAL VERT — menu title text alignment vertical (NORMAL, TOP, CAP, HALF)

Description:

Set the menu title text alignment

Set Menu Title Text Color Index

SUBROUTINE CMMTCI (COLOR)

Input Parameters:

INTEGER COLOR menu title text color index

Description:

Set the menu title color index

Set Menu Title Text Font

SUBROUTINE CMMTFO (FONT)

Input Parameters:

INTEGER FONT menu title text font

Description:

Set the menu title text font

Set Menu Title Text Index

SUBROUTINE CMMTTI (INDEX)

Input Parameters:

INTEGER INDEX menu title bundled text attribute index

Description:

Set the menu title bundled text attribute index

Set Menu Title Text Precision

SUBROUTINE CMMTPR (PREC)

Input Parameters:

INTEGER PREC menu title text precision

Description:

Set the menu title text precision

Set Menu Title Character Up Vector

SUBROUTINE CMMTUP (CHUX, CHUY)

Input Parameters:

REAL CHUX, CHUY menu title character up vector

Description:

Set the menu title character up vector

Set Menu Title Area Background Flag

SUBROUTINE CMMTBF (FLAG)

Input Parameters:

INTEGER FLAG menu title area background flag

(ON, OFF)

Description:

Specifies whether background fill area is to be displayed

Set Menu Title Area Outline Flag

SUBROUTINE CMMTOF (FLAG)

Input Parameters:

INTEGER FLAG menu title area outline flag

(ON, OFF)

Description:

Specifies whether outline of menu title background is to be displayed

Set Menu Title Area Background Color Index

SUBROUTINE CMMTBC (COLOR)

Input Parameters:

INTEGER COLOR menu title area background color index

Description:

Set the menu title background fill area color index

Set Menu Title Area Outline Color Index

SUBROUTINE CMMTOC (COLOR)

Input Parameters:

INTEGER COLOR menu title area outline color index

Description:

Set the menu title background area outline color index

Set Menu Title Area Background Interior Style

SUBROUTINE CMMTBS (STYLE)

Input Parameters:

INTEGER STYLE menu title area background interior style

Description:

Set the menu title background interior style

Set Menu Title Area Background Interior Style Index

SUBROUTINE CMMTBI (INDEX)

Input Parameters:

INTEGER INDEX menu title area background interior style index

Description:

Set the menu title background interior style index

Set Menu Title Area Outline Line Type

SUBROUTINE CMMTOT (TYPE)

Input Parameters:

INTEGER TYPE menu title area outline line type

Description:

Specifies the line type for menu title area background outline

Set Menu Title Area Outline Width Factor

SUBROUTINE CMMTOW (WIDTH)

Input Parameters:

REAL WIDTH menu title area outline width factor

Description:

Set the menu title area outline width factor

Set Menu Item Text Path

SUBROUTINE CMMICP (PATH)

Input Parameters:

INTEGER PATH menu item text path

(RIGHT, LEFT, UP, DOWN)

Description:

Set the menu item text path

Set Menu Item Character Height

SUBROUTINE CMMICH (HEIGHT)

Input Parameters:

REAL HEIGHT menu item character height

Description:

Set the menu item character height

Set Menu Item Character Spacing

SUBROUTINE CMMICS (SPACE)

Input Parameters:

REAL SPACE menu item character spacing

Description:

Set the menu item character spacing

Set Menu Item Character Expansion Factor

SUBROUTINE CMMIXP (EXPANS)

Input Parameters:

REAL EXPANS	menu item character expansion factor

Description:

Set the menu item character expansion factor

Set Menu Item Text Alignment

SUBROUTINE CMMIAL (HORIZ, VERT)

Input Parameters:

REAL HORIZ	menu item text alignment horizontal (NORMAL, LEFT, CENTER, RIGHT)
REAL VERT	menu item text alignment vertical (NORMAL, TOP, CAP, HALF)

Description:

Set the menu item text alignment

Set Menu Item Text Color Index

SUBROUTINE CMMICI (COLOR)

Input Parameters:

INTEGER COLOR menu item text color index

Description:

Set the menu item text color index

Set Menu Item Text Font

SUBROUTINE CMMIFO (FONT)

Input Parameters:

INTEGER FONT menu item text font

Description:

Set the menu item text font

Set Menu Item Text Index

SUBROUTINE CMMITI (INDEX)

Input Parameters:

INTEGER INDEX menu item text index

Description:

Set the menu item bundled text attribute index

Set Menu Item Text Precision

SUBROUTINE CMMIPR (PREC)

Input Parameters:

INTEGER PREC menu item text precision

Description:

Set the menu item text precision

Set Menu Item Character Up Vector

SUBROUTINE CMMIUP (CHUX, CHUY)

Input Parameters:

REAL CHUX, CHUY menu item character up vector

Description:

Set the menu item character up vector

Set Menu Item Area Background Flag

SUBROUTINE CMMIBF (FLAG)

Input Parameters:

INTEGER FLAG menu item area background flag (ON, OFF)

Description:

Specifies whether background fill area is to be displayed

Set Menu Item Area Outline Flag

SUBROUTINE CMMIOF (FLAG)

Input Parameters:

INTEGER FLAG menu item area outline flag (ON, OFF)

Description:

Specifies whether outline of menu title background fill area is to be displayed

Set Menu Item Area Background Color Index

SUBROUTINE CMMIBC (COLOR)

Input Parameters:

INTEGER COLOR menu item background color index

Description:

Set the menu item background fill area color index

Set Menu Item Area Outline Color Index

SUBROUTINE CMMIOC (COLOR)

Input Parameters:

INTEGER COLOR menu item area outline color index

Description:

Set the menu item outline color index

Set Menu Item Area Background Interior Style

SUBROUTINE CMMIBS (STYLE)

Input Parameters:

INTEGER STYLE menu item area background interior style

Description:

Set the menu item area background interior style

Set Menu Item Area Background Interior Style Index

SUBROUTINE CMMIBI (INDEX)

Input Parameters:

INTEGER INDEX menu item area background interior style index

Description:

Set the menu item area background interior style index

Set Menu Item Area Outline Line Type

SUBROUTINE CMMIOT (TYPE)

Input Parameters:

INTEGER TYPE menu item area outline line type

Description:

Set the menu item area outline line type

Set Menu Item Area Outline Width Factor

SUBROUTINE CMMIOW (WIDTH)

Input Parameters:

REAL WIDTH menu item area outline width factor

Description:

Set the menu item area outline width factor

Set Menu Prompt Dialogue Identifier

SUBROUTINE CMMPDA (DLGID)

Input Parameters:

INTEGER DLGID menu prompt dialogue identifier

Description:

Specifies dialogue area for automatic prompt display for the menu structure

Set Menu Prompt String

SUBROUTINE CMMPST (LENGTH, STRING)

Input Parameters:

INTEGER LENGTH length of prompt string

CHARACTER STRING menu prompt string

Description:

Specifies prompt string for the menu structure

Set Menu Title Location

SUBROUTINE CMMTLC (XLOC, YLOC)

Input Parameters:

REAL XLOC X coordinate of menu title

REAL YLOC Y coordinate of menu title

Description:

Set the menu title location

Set Menu Item Location

SUBROUTINE CMMILC (NITEMS, XLOC, YLOC)

Input Parameters:

INTEGER NITEMS	no. of menu items
REAL XLOC(*)	X coordinates of menu items
REAL YLOC(*)	Y coordinates of menu items

Description:

Set the menu item location

Set Title Icon Transformation Matrix

SUBROUTINE CMMTXF (XFORM)

Input Parameters:

REAL XFORM(4, 4)	Transformation matrix for menu title icon

Description:

Set the title Icon transformation matrix

Set Items Icon Transformation Matrices

SUBROUTINE CMMIXF (NITEMS, XFORM)

Input Parameters:

INTEGER NITEMS	no. of menu items
REAL XFORM(4, 4, *)	Transformation matrices for menu item icons

Description:

Set the item Icon transformation matrices

Set Menu Location Mode

SUBROUTINE CMMLCM (FLAG)

Input Parameters:

INTEGER FLAG	menu location mode (INDIVIDUAL, BUNDLED)

Description:

Set the menu location mode

Set Menu Bundled Location Path

SUBROUTINE CMMBLP (PATH)

Input Parameters:

INTEGER PATH	path for spacing menu items for bundled location mode (LEFT,RIGHT,UP,DOWN)

Description:

Set the path for locating menu items in the bundled location mode

User Communication Interface

Set Dialog Area Character Height

SUBROUTINE CMDGCH (DGID, HEIGHT)

Input Parameters:

INTEGER DGID	dialog area identifier
REAL HEIGHT	dialog area character height

Description:

Set the dialog area character height

Set Dialog area Character Spacing

SUBROUTINE CMDGCS (DGID, SPACE)

Input Parameters:

INTEGER DGID	dialog area identifier
REAL SPACE	dialog area character spacing

Description:

Set the dialog area character spacing

Set Dialog Area Character Expansion Factor

SUBROUTINE CMDGXP (DGID, EXPANS)

Input Parameters:

INTEGER DGID	dialog area identifier

REAL EXPANS dialog area character expansion factor

Description:

Set the dialog area character expansion factor

Set Dialog Area Text Color Index

SUBROUTINE CMDGCI (DGID, COLOR)

Input Parameters:

INTEGER DGID dialog area identifier

INTEGER COLOR dialog area text color index

Description:

Set the dialog area text color index

Set Dialog Area Text Font

SUBROUTINE CMDGFO (DGID, FONT)

Input Parameters:

INTEGER DGID dialog area identifier

INTEGER FONT dialog area text font

Description:

Set the dialog area text font

Set Dialog Area Text Index

SUBROUTINE CMDGTI (DGID, INDEX)

Input Parameters:

INTEGER DGID dialog area identifier

INTEGER INDEX dialog area text index

Description:

Set the dialog area bundled text attribute index

Set Dialog Area Text Precision

SUBROUTINE CMDGPR (DGID, PREC)

Input Parameters:

INTEGER DGID dialog area identifier

INTEGER PREC dialog area text precision

Description:

Set the dialog area text precision

Set Dialog Area Background Flag

SUBROUTINE CMDGBF (DGID, FLAG)

Input Parameters:

INTEGER DGID dialog area identifier

INTEGER FLAG dialog area background flag

(ON , OFF)

Description:

Specifies whether the dialog background fill area is to be displayed

Set Dialog Area Outline Flag

SUBROUTINE CMDGOF (DGID, FLAG)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER FLAG	dialog area outline flag

Description:

Specifies whether the dialog area outline is to be displayed

Set Dialog Area Background Color Index

SUBROUTINE CMDGBC (DGID, COLOR)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER COLOR	dialog area background color

Description:

Set the dialog area background color index

Set Dialog Area Outline Color Index

SUBROUTINE CMDGOC (DGID, COLOR)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER COLOR	dialog area outline color index

Description:

Set the dialog area outline color index

Set Dialog Area Background Interior Style

SUBROUTINE CMDGBS (DGID, STYLE)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER STYLE	dialog area background interior style

Description:

Set the dialog area background interior style

Set Dialog Area Background Interior Style Index

SUBROUTINE CMDGBI (DGID, INDEX)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER INDEX	dialog area background interior style index

Description:

Set the dialog area background interior style index

Set Dialog Area Outline Line Type

SUBROUTINE CMDGOT (DGID, TYPE)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER TYPE	dialog area outline line type

Description:

Set the dialog area outline line type

Set Dialog Area Outline Width Factor

SUBROUTINE CMDGOW (DGID, WIDTH)

Input Parameters:

INTEGER DGID	dialog area identifier
REAL WIDTH	dialog area outline width factor

Description:

Set the dialog area outline width factor

Set Dialog Area Buffer Size

SUBROUTINE CMDGBU (DGID, NBUF)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER NBUF	dialog area buffer size

Description:

Set the no. of dialog area lines to be saved in the buffer

Set Dialog Area No. of Displayed Lines

SUBROUTINE CMDGNL (DGID, NLINE)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER NLINE	dialog area no. of displayed lines

Description:

Set the no. of dialog area lines to be displayed

(including the input line)

Set Dialog Area No. of Characters Per Line

SUBROUTINE CMDGNC (DGID, NCHAR)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER NCHAR	dialog area no. of characters per line

Description:

Set the dialog area no. of characters per line

Set Dialog Area Scroll Mode

SUBROUTINE CMDGMD (DGID, MODE)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER MODE	dialog area scroll mode (no-scroll/ scroll)

Description:

Set the dialog area scroll mode

Set Dialog Area Location

SUBROUTINE CMDGLC (DGID, X1, X2, Y1, Y2)

Input Parameters:

INTEGER DGID	dialog area identifier
REAL X1, X2, Y1, Y2	corner points of the rectangle

Description:

Define the corner points of the rectangular dialog area

Set Dialog Area String Prefixes

SUBROUTINE CMSDPF (DGID, MENU, SYSTEM)

Input Parameters:

INTEGER DGID	dialog area identifier
CHARACTER*1 MENU	prefix for menu input
CHARACTER*1 SYSTEM	prefix for host system command

Description:

Set the special character prefixes for dialog area string input

Set Dialog Area Echo Mode

SUBROUTINE CMDGEM (DGID, ECHO)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER ECHO	dialog area echo mode (ON, OFF)

Description:

Set the dialog area echo mode

CAD View Manager

Set View Area Background Flag

SUBROUTINE CMVWBF (VWID, FLAG)

Input Parameters:

INTEGER VWID	view identifier
INTEGER FLAG	view area background flag
	(ON, OFF)

Description:

Specifies whether the view area background is to be displayed

Set View Area Outline Flag

SUBROUTINE CMVWOF (VWID, FLAG)

Input Parameters:

INTEGER VWID	view identifier
INTEGER FLAG	view area outline flag

Description:

Specifies whether the view area outline is to be displayed

Set View Area Background Color Index

SUBROUTINE CMVWBC (VWID, COLOR)

Input Parameters:

INTEGER VWID view identifier

INTEGER COLOR view area background color index

Description:

Set the view area background color index

Set View Area Outline Color Index

SUBROUTINE CMVWOC (VWID, COLOR)

Input Parameters:

INTEGER VWID view identifier

INTEGER COLOR view area outline color index

Description:

Set the view area outline color index

Set View Area Background Interior Style

SUBROUTINE CMVWBS (VWID, STYLE)

Input Parameters:

INTEGER VWID view identifier

INTEGER STYLE view area background interior style

Description:

Set the view area background interior style

Set View Area Background Interior Style Index

SUBROUTINE CMVWBI (VWID, INDEX)

Input Parameters:

INTEGER VWID	view identifier
INTEGER INDEX	view area background interior style index

Description:

Set the view area background interior style index

Set View Area Outline Line Type

SUBROUTINE CMVWOT (VWID, TYPE)

Input Parameters:

INTEGER VWID	view identifier
INTEGER TYPE	view area outline line type

Description:

Set the view area background outline line type

Set View Area Outline Width Factor

SUBROUTINE CMVWOW (VWID, WIDTH)

Input Parameters:

INTEGER VWID	view identifier
REAL WIDTH	view area outline width factor

Description:

Set the view area outline width factor

Menu Structure Functions

Create Menu Root

SUBROUTINE CMCMRT (MENUID)

Input Parameters:

INTEGER MENUID menu structure identifier

Description:

Creates a menu tree starting from a specified menu structure (root menu)

Unpost Menu Root

SUBROUTINE CMUPMN (WKID, MENUID)

Input Parameters:

INTEGER WKID workstation identifier

INTEGER MENUID menu structure identifier

Description:

Unposts a menu root from a workstation.

Execute Menu

SUBROUTINE CMEXMN (MENUID)

Input Parameters:

INTEGER MENUID menu structure identifier

Description:

Executes a menu sub structure

Open Menu Structure

SUBROUTINE CMOMST (MSTRID)

Input Parameters:

INTEGER MSTRID menu structure identifier

Description:

Opens a menu sub structure

Close Menu Structure

SUBROUTINE CMCMST

Input Parameters:

none

Description:

Closes a menu sub structure

Set Menu Structure Label

SUBROUTINE CMMSLB (LABEL)

Input Parameters:

INTEGER LABEL label

Description:

Sets a label in a menu structure

Set Element Pointer in Menu Structure

SUBROUTINE CMMSEP (EP)

Input Parameters:

INTEGER EP element pointer

Description:

Sets the current element pointer in the menu structure

Offset Element Pointer in Menu Structure

SUBROUTINE CMMOEP (OFFSET)

Input Parameters:

INTEGER OFFSET no. of elements by which to offset the pointer

Description:

Offsets the current element pointer in the menu structure

Set Element Pointer at Label in Menu Structure

SUBROUTINE CMMEPL (LABEL)

Input Parameters:

INTEGER LABEL label

Description:

Sets the current element pointer at a label in a menu structure

Delete Menu Structure Element

SUBROUTINE CMMDEL

Input Parameters:

none

Description:

Deletes the current element in a menu structure

Delete Menu Structure Elements Between Range

SUBROUTINE CMMDER (EP1, EP2)

Input Parameters:

INTEGER EP1	start element number
INTEGER EP2	end element number

Description:

Deletes all the elements in a given range in a menu structure

Delete Menu Structure Elements Between Labels

SUBROUTINE CMMDLL (LABEL1, LABEL2)

Input Parameters:

INTEGER LABEL1	label from which elements are to be deleted
INTEGER LABEL2	label till which elements are to be deleted

Description:

Deletes all the elements between two labels in a menu structure

Empty Menu Structure

SUBROUTINE CMEMST (MSTRID)

Input Parameters:

INTEGER MSTRID menu structure identifier

Description:

Empties a menu structure and removes all the elements in the menu structure

Delete Menu Structure

SUBROUTINE CMDMST (MSTRID)

Input Parameters:

INTEGER MSTRID menu structure identifier

Description:

Deletes a menu structure

Delete All Menu Structures

SUBROUTINE CMDAMS

Input Parameters:

none

Description:

Deletes all menu structures

Unpost All Menu Structures

SUBROUTINE CMUAMS (WKID)

Input Parameters:

INTEGER WKID workstation identifier

Description:

Unposts all menu structures from a workstation

Modified PHIGS Functions

Await Event

SUBROUTINE CMWAIT (TIME, WKID, ICL, IDNR)

Input Parameters:

REAL TIME	time out (seconds)
INTEGER WKID	workstation identifier

Output Parameters:

INTEGER ICL	class of input device
INTEGER IDNR	logical input device number

Description:

Await event

Get Hierarchical Pick

SUBROUTINE CMGTHP (NDEPTH, ISTAT, PPD, PP)

Input Parameters:

INTEGER NDEPTH	depth of pick path to be returned

Output Parameters:

INTEGER ISTAT	pick status
INTEGER PPD	depth of pick path returned
INTEGER PP(3,*)	pick path

Description:

Get hierarchical pick path

Get String

SUBROUTINE CMGTST (LOST, STR)

Input Parameters:

none

Output Parameters:

INTEGER LOST	length of input string
CHARACTER STR*(*)	input string

Description:

Get string input pick path

Initialize String Input Device

SUBROUTINE CMINST (WKID, DGID, STDNR, LENT, TEXT)

Input Parameters:

INTEGER WKID	workstation identifier
INTEGER DGID	dialog area identifier
INTEGER STDNR	string input device number
INTEGER LENT	length of initial string
CHARACTER TEXT*(*)	initial string

Description:

Initialize string input device for dialog area

CAD View Functions

Define Transformation for Predefined Viewing Facility

SUBROUTINE CMDFVW (VIEWID, PRDFID)

Input Parameters:

INTEGER VIEWID	view index of view whose current transformation is to be stored
INTEGER PRDFID	predefined view transformation index

Description:

Stores viewing transformation with a view transformation index

Set Predefined Viewing Transformation

SUBROUTINE CMSPVW (VIEWID, PRDFID)

Input Parameters:

INTEGER VIEWID	view index to be used for predefined viewing transformation
INTEGER PRDFID	predefined view transformation index

Description:

Transforms a view with a predefined view transformation index

Define View Transformation Index for a Predefined Transformation Table

SUBROUTINE CMDVTI (N, INDEX, XFORM)

Input Parameters:

INTEGER N	no. of indices to be defined
INTEGER INDEX(*)	array of transformation indices
INTEGER XFORM(*)	array of predefined transformations (XROT, YROT, ZROT, XTRAN, YTRAN, ZTRAN, SCALE)

Description:

Defines view transformation indices for predefined transformations

Define Input Device - View Transformation Map

SUBROUTINE CMIDTM (IDNR, NXFORM, XFORM)

Input Parameters:

INTEGER IDNR	input device number (valuator)
INTEGER NXFORM	no. of view transformation indices to be mapped to the input device
INTEGER XFORM(*)	array of view transformation indices

Description:

Maps an input device (valuator) to a no. of view transformation indices

Define View Transformation Index - View Index Map

SUBROUTINE CMVTVM (VTINDX, NVIEWS, VIEWS)

Input Parameters:

INTEGER VTINDX	predefined view transformation index
INTEGER NVIEWS	no. of views to be mapped to the view transformation index
INTEGER VIEWS(*)	array of view indices

Description:

Maps a view transformation index to a number of PHIGS views

Miscellaneous Functions

Set Dialog Area Visibility

SUBROUTINE CMDGVS (DGID, VIS)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER VIS	dialog area visibility
	(ON, OFF)

Description:

Sets the dialog area visibility flag

Define Global Menu

SUBROUTINE CMDFGM (ROOT)

Input Parameters:

INTEGER ROOT	root of the global menu tree

Description:

Sets a menu tree to be the global menu tree

Extract Values From String

SUBROUTINE CMEXNM (STRING, IER, NVALS, VALS)

Input Parameters:

CHARACTER*(*) STRINGcharacter string containing numerical values

Output Parameters:

INTEGER IER	error indicator
INTEGER NVALS	number of values
REAL VALS(*)	numerical values in the string

Description:

Parses a character string and extracts numerical values

Associate Dialog Area With A Menu Tree

SUBROUTINE CMADGM (DGID, ROOT)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER ROOT	root menu structure of menu tree

Description:

Associates a dialog area with a menu tree for string menu selection

Set Dialog Area Priority

SUBROUTINE CMDGPR (DGID, REFDG, RPRIOR)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER REFDG	reference dialog area identifier
INTEGER RPRIOR	relative priority (HIGHER, LOWER)

Description:

Sets the priority of a dialog area with respect to another dialog area

Scroll Dialog Area

SUBROUTINE CMSCDG (DGID, NLINES)

Input Parameters:

INTEGER DGID	dialog area identifier
INTEGER NLINES	no. of lines to be scrolled (positive for scroll up, negative for scroll down)

Description:

Srolls a dialog area

Reset Scrolled Dialog Area

SUBROUTINE CMRSDG (DGID)

Input Parameters:

INTEGER DGID	dialog area identifier

Description:

Resets a scrolled dialog area

Appendix B. CADMADE Functions Supported by the Prototype UIE

This section contains a list of CADMADE functions which are supported by the prototype implementation of the UIE discussed in this dissertation. The names of the subroutines are arranged in alphabetical order. A * after the subroutine name indicates that the subroutine in the implementation differs from the binding suggested in appendix A. A ** after the subroutine name indicates that the function has not been fully implemented.

CMCMRT	CMCMST	CMDGBC
CMDGBF	CMDGBI	CMDGBS
CMDGBU**	CMDGCH	CMDGCI
CMDGCS	CMDGFO	CMDGLC
CMDGMD**	CMDGNC	CMDGNL
CMDGOC	CMDGOF	CMDGOT
CMDGOW	CMDGPR	CMDGTI
CMDGVS	CMDGXP	CMEXMN
CMGTHP	CMGTST	CMIFBM
CMINST*	CMMDEL**	CMMDER**
CMMDLL**	CMMEPL**	CMMIAL
CMMIBC	CMMIBF	CMMIBI
CMMIBS	CMMICH	CMMICI
CMMICP	CMMICS	CMMIFO
CMMIIC**	CMMILC	CMMIOC
CMMIOF	CMMIOT	CMMIOW
CMMIPR	CMMIST	CMMITI
CMMITX	CMMIUP	CMMIXP
CMMOEP**	CMMPDA	CMMPST
CMMSEP**	CMMSG	CMMSLB
CMMTAL	CMMTBC	CMMTBF
CMMTBI	CMMTBS	CMMTCH
CMMTCI	CMMTCP	CMMTCS
CMMTFO	CMMTIC**	CMMTLC
CMMTOC	CMMTOF	CMMTOT
CMMTOW	CMMTPR	CMMTST

CMMTTI	CMMTTX	CMMTUP
CMMTXP	CMNXMN	CMOMST
CMOPDM**	CMOPUI	CMPOMN
CMUPMN	CMWAIT	

Appendix C. Code Listing - Prototype UIE

This section contains a listing of the code written to implement the prototype User Interface Environment. All modules starting with "CM" are CADMADE functions which can be accessed by the applications programmer.

```
C=====================================================================
C                          C A D M A D E   M O D U L E   C M O P U I
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C    PART  :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMOPUI (WKID, HPDNR, ERFIL, FNAME)
C=====================================================================
C INPUT PARAMETERS:
C     WKID  - INTEGER - WORKSTATION IDENTIFIER
C     HPDNR - INTEGER - HIERARCHICAL PICK DEVICE NUMBER FOR MENU PICK
C     ERFIL - INTEGER - ERROR FILE LOGICAL UNIT NUMBER
C     FNAME - CHARACTER*(*) - EROOR FILE NAME
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DATSTR
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE - OPEN USER INTERFACE ENVIRONMENT
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/05/89 (18:19:54)
C=====================================================================

      SUBROUTINE CMOPUI (WKID, HPDNR, ERFIL, FNAME)

      INTEGER WKID, HPDNR, ERFIL
      CHARACTER*(*) FNAME

      INTEGER DATLUN
      COMMON /DATSTR/ DATLUN

C     SET THE LOGICAL UNIT NUMBER FOR THE DATA STRUCTURE FILE
      DATLUN = 99

C     OPEN THE USER INTERFACE ERROR FILE
      OPEN (UNIT=ERFIL, FILE = FNAME)

C     SET THE MENU ATTRIBUTE DEFAULTS
      CALL CLMNAT

C     SET THE DIALOG AREA ATTRIBUTE DEFAULTS
      CALL CLDGAT

C     SET THE NAME 126 TO BE NOT PICKABLE
      CALL PSHPFT (WKID, HPDNR, 1, 127, 1, 126)

C     SET THE NAME 126 TO BE INVISIBLE
      CALL PSIVFT (WKID, 1, 126, 1, 127)

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M I F B M
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C    PART  :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMIFBM (WKID, ASSNUM, OBJNUM, INSNUM, ASNAME, OBNAME,
C    >                   UNUM, WNUM, VIEWID, PRIORT)
```

```
C=======================================================================
C INPUT PARAMETERS:
C      WKID - INTEGER - WORKSTATION IDENTIFIER
C      ASSNUM - INTEGER - ASSEMBLY IDENTIFIER
C      OBJNUM - INTEGER - OBJECT IDENTIFIER
C      INSNUM - INTEGER - INSTANCE IDENTIFIER
C      ASNAME - CHARACTER*(*) - ASSEMBLY NAME
C      OBNAME - CHARACTER*(*) - OBJECT NAME
C      UNUM   - INTEGER - NUMBER OF INTERPOLATION LINES IN THE U
C                         DIRECTION FOR WIREFRAME SURFACE PATCHES
C      WNUM   - INTEGER - NUMBER OF INTERPOLATION LINES IN THE W
C                         DIRECTION FOR WIREFRAME SURFACE PATCHES
C      VIEWID - INTEGER - VIEW INDEX FOR DISPLAYING THE FEATURE MODELS
C      PRIORT - INTEGER - PHIGS STRUCTURE PRIORITY FOR THE MODELS
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C      NONE
C=======================================================================
C COMMON OUTPUTS:
C      IDS, COMP, PRTOF, PATCH
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C      CADMADE - INITIALIZE FEATURE BASED MODELING
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C      DATE:  03/05/89 (18:19:54)
C=======================================================================

      SUBROUTINE CMIFBM (WKID, ASSNUM, OBJNUM, INSNUM, ASNAME, OBNAME,
     >                   UNUM, WNUM, VIEWID, PRIORT)
      INTEGER WKID, ASSNUM, OBJNUM, INSNUM, UNUM, WNUM, VIEWID
      CHARACTER*(*) ASNAME, OBNAME
      REAL PRIORT

      INTEGER ASNUM, OBNUM, INNUM
      COMMON /IDS/ ASNUM, OBNUM, INNUM

      CHARACTER*8 ASSEM(900), OBJECT(900)
      COMMON /COMP/ ASSEM, OBJECT

      INTEGER CNUM
      COMMON /PRTOF/ CNUM

      INTEGER NU, NW
      COMMON /PATCH/ NU, NW

      REAL WIN(4), VPT(4)
      DATA WIN/ 0.,1.,0.,1./
      DATA VPT/ 0.1, 0.95, 0.005, 0.145/

C     INITIALIZE THE COMMON BLOCKS FOR THE FEATURE BASED MODELER
      ASNUM = ASSNUM
      OBNUM = OBJNUM
      INNUM = INSNUM

      CNUM = OBJNUM
      ASSEM(ASSNUM) = ASNAME
      OBJECT(OBJNUM) = OBNAME

      NU = UNUM
      NW = WNUM

C     INITIALIZE THE VIEW FOR THE TEMPLATES OF THE FEATURE BASED MODELER
      CALL GPVMP2(WKID,5,WIN, VPT)
      CALL GPVCH (WKID,5,1,1,1,2,0,2,1,2)

C     INITIALIZE THE OBJECT PHIGS STRUCTURE
      CALL POPST (OBJNUM)

      CALL PSVWI(VIEWID)

      CALL PADS(1,127)
      CALL PSHPID(OBJNUM)

      CALL PCLST
```

```
C     POST THE OBJECT PHIGS STRUCTURE
      CALL PPORT (WKID, OBJNUM, PRIORT)

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M O P D M
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMOPDM (WKID, ERFIL, FNAME)
C=====================================================================
C INPUT PARAMETERS:
C     WKID - INTEGER - WORKSTATION IDENTIFIER
C     ERFIL - INTEGER - ERROR FILE LOGICAL UNIT NUMBER
C     FNAME - CHARACTER*(*) - EROOR FILE NAME
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE - OPEN DESIGN AND MODELING ENVIRONMENT
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/05/89 (18:19:54)
C=====================================================================

      SUBROUTINE CMOPDM (WKID, ERFIL, FNAME)

******THIS SUBROUTINE IS NOT FUNCTIONAL YET
      INTEGER WKID, ERFIL
      CHARACTER*(*) FNAME

C     OPEN THE CAD DATA STRUCTURE FILE

C     OPEN VARIOUS OTHER FILES INCLUDING THE ERROR FILES

C     SET THE DEFAULTS


      RETURN
      END




C=====================================================================
C                          C A D M A D E   M O D U L E   C M M T T X
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMTTX (LENGTH, NPTBFA, XBFA, YBFA, TITLE)
C=====================================================================
C INPUT PARAMETERS:
C     LENGTH - INTEGER - LENGTH OF THE TITLE CHARACTER STRING
C     NPTBFA - INTEGER - NO. OF POINTS IN THE BACKGROUND FILL AREA
C     XBFA   - REAL(*) - ARRAY OF X COORDINATES OF THE FILL AREA
```

```
C     YBFA   - REAL(*) - ARRAY OF Y COORDINATES OF THE FILL AREA
C     TITLE  - CHARACTER*(*) - THE TITLE TEXT
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1010 - CADMADE MENU TITLE TEXT
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (10:12:24)
C=====================================================================

      SUBROUTINE CMMTTX (LENGTH, NPTBFA, XBFA, YBFA, TITLE)

      INTEGER LENGTH, NPTBFA

      REAL XBFA(*), YBFA(*)

      CHARACTER*(*) TITLE

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1010)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE INTEGER PARAMETERS
      WRITE(DATLUN, *) LENGTH, NPTBFA

C     WRITE THE REAL PARAMETERS
      WRITE(DATLUN, 1001) (XBFA(I), I=1,NPTBFA)
      WRITE(DATLUN, 1001) (YBFA(I), I=1,NPTBFA)

C     WRITE THE CHARACTER PARAMETER
      WRITE(DATLUN, '(A)') TITLE

1001  FORMAT (6E12.5)

      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M M T I C
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMTIC (STRID, NPTBFA, XBFA, YBFA)
C=====================================================================
C INPUT PARAMETERS:
C     STRID  - INTEGER - PHIGS STRUCTURE TO BE USED AS THE ICON
C     NPTBFA - INTEGER - NO. OF POINTS IN THE BACKGROUND FILL AREA
C     XBFA   - REAL(*) - ARRAY OF X COORDINATES OF THE FILL AREA
C     YBFA   - REAL(*) - ARRAY OF Y COORDINATES OF THE FILL AREA
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
```

```
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1012 - CADMADE MENU TITLE ICON
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (10:14:43)
C=====================================================================

      SUBROUTINE CMMTIC (STRID, NPTBFA, XBFA, YBFA)


      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1012)

      WRITE(DATLUN, *) ELEMID




      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M M I T X
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMITX (NITEMS, LENGTH, NPBFA, MENUID, XBFA, YBFA, ITEMS)
C=====================================================================
C INPUT PARAMETERS:
C     NITEMS - INTEGER - NUMBER OF ITEMS
C     LENGTH - INTEGER(*) - LENGTH OF THE ITEM CHARACTER STRINGS
C     NPTBFA - INTEGER(*) - NO. OF POINTS IN EACH BACKGROUND FILL AREA
C     MENUID - INTEGER(*) - ARRAY OF MENU PICK IDENTIFIERS
C     XBFA   - REAL(*) - ARRAY OF X COORDINATES OF THE FILL AREAS
C     YBFA   - REAL(*) - ARRAY OF Y COORDINATES OF THE FILL AREAS
C     ITEMS(*)  - CHARACTER*(*) - THE ITEM STRINGS
C
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1014 - CADMADE MENU ITEM TEXT
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (10:17:59)
C=====================================================================

      SUBROUTINE CMMITX (NITEMS, LENGTH, NPBFA, MENUID, XBFA,YBFA,ITEMS)

      INTEGER NITEMS, LENGTH(*), NPBFA(*), MENUID(*)

      REAL XBFA(*), YBFA(*)

      CHARACTER*(*) ITEMS(*)

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1014)
```

```
      WRITE(DATLUN, *) ELEMID

C     WRITE THE INTEGER PARAMETERS
      WRITE(DATLUN, *) NITEMS

      WRITE(DATLUN, 1002) (LENGTH(I), I=1,NITEMS)
      WRITE(DATLUN, 1002) (NPBFA (I), I=1,NITEMS)
      WRITE(DATLUN, 1002) (MENUID(I), I=1,NITEMS)

C     CALCULATE THE TOTAL NUMBER OF POINTS REQUIRED FOR THE BACKGROUND
      NTOT = 0

      DO 100 I = 1, NITEMS

         NTOT = NTOT + NPBFA(I)

100   CONTINUE
C     WRITE THE REAL PARAMETERS
      WRITE(DATLUN, 1001) (XBFA(I), I=1,NTOT)
      WRITE(DATLUN, 1001) (YBFA(I), I=1,NTOT)

C     WRITE THE CHARACTER PARAMETER
      DO 200 I = 1, NITEMS

         WRITE(DATLUN, '(A)') ITEMS(I)

200   CONTINUE

1001  FORMAT (6E12.5)
1002  FORMAT (6I12)

      RETURN
      END

C=======================================================================
C                          C A D M A D E   M O D U L E   C M M I I C
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMIIC (NITEMS, STRID, NPBFA, MENUID, XBFA, YBFA)
C=======================================================================
C INPUT PARAMETERS:
C     NITEMS - INTEGER - NUMBER OF ITEMS
C     STRID  - INTEGER(*) - PHIGS STRUCTURES TO BE USED AS THE ICONS
C     NPBFA  - INTEGER(*) - NO. OF POINTS IN EACH BACKGROUND FILL AREA
C     MENUID - INTEGER(*) - ARRAY OF MENU PICK IDENTIFIERS
C     XBFA   - REAL(*) - ARRAY OF X COORDINATES OF THE FILL AREAS
C     YBFA   - REAL(*) - ARRAY OF Y COORDINATES OF THE FILL AREAS
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1016 - CADMADE MENU ITEM ICON
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (10:19:10)
C=======================================================================

      SUBROUTINE CMMIIC (NITEMS, STRID, NPBFA, MENUID,XBFA,YBFA)

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1016)

      WRITE(DATLUN, *) ELEMID
```

```
      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M M T L C
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMTLC (XLOC, YLOC)
C=====================================================================
C INPUT PARAMETERS:
C     XLOC - REAL - X LOCATION OF THE MENU TITLE
C     YLOC - REAL - Y LOCATION OF THE MENU TITLE
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1020 - CADMADE MENU TITLE LOCATION
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (10:25:15)
C=====================================================================

      SUBROUTINE CMMTLC (XLOC, YLOC)

      REAL XLOC, YLOC

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1020)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE MENU TITLE LOCATION INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) XLOC, YLOC


      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M M I L C
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMILC (NITEMS, XLOC, YLOC)
C=====================================================================
C INPUT PARAMETERS:
C     NITEMS - INTEGER - NUMBER OF ITEMS
C     XLOC - REAL(*) - X LOCATIONS OF THE MENU ITEMS
C     YLOC - REAL(*) - Y LOCATIONS OF THE MENU ITEMS
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
```

```
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1030 - CADMADE MENU ITEM LOCATION
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (10:27:48)
C=======================================================================

      SUBROUTINE CMMILC (NITEMS, XLOC, YLOC)

      INTEGER NITEMS
      REAL XLOC(*), YLOC(*)

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1030)

      INTEGER MAXITM, NMAX
      PARAMETER (MAXITM = 20)

      WRITE(DATLUN, *) ELEMID

C     CHECK TO FIND THE MAXIMUM NUMBER OF MENU ITEMS
      NMAX = MIN (NITEMS, MAXITM)

C     WRITE THE NUMBER OF ITEM LOCATIONS SPECIFIED
      WRITE(DATLUN, *) NMAX

C     WRITE THE MENU TITLE LOCATION INTO THE DATA STRUCTURE
      WRITE(DATLUN, 1001) (XLOC(I), I=1, NMAX)
      WRITE(DATLUN, 1001) (YLOC(I), I=1, NMAX)

1001  FORMAT (6E12.5)

      RETURN
      END

C=======================================================================
C                        C A D M A D E  M O D U L E  C M E X M N
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMEXMN (MENUID)
C=======================================================================
C INPUT PARAMETERS:
C     MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE EXECUTE MENU
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
```

```
C      DATE:  03/05/89 (09:17:43)
C=====================================================================

       SUBROUTINE CMEXMN (MENUID)

       INTEGER MENUID

       INTEGER ELEMID, DATLUN
       COMMON /DATSTR/ DATLUN
       PARAMETER (ELEMID = 1001)

       WRITE(DATLUN, *) ELEMID
       WRITE(DATLUN, *) MENUID

       RETURN
       END



C=====================================================================
C                          C A D M A D E   M O D U L E   C M M T C P
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C      CALL CMMTCP (PATH)
C=====================================================================
C INPUT PARAMETERS:
C      PATH - INTEGER - TEXT PATH
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C      DATSTR
C=====================================================================
C COMMON OUTPUTS:
C      NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C      1050 - CADMADE SET MENU TITLE TEXT PATH
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C      DATE:  02/18/89 (20:01:38)
C=====================================================================
C=====================================================================

       SUBROUTINE CMMTCP (PATH)

       INTEGER PATH

       INTEGER ELEMID, DATLUN
       COMMON /DATSTR/ DATLUN
       PARAMETER (ELEMID = 1050)

       WRITE(DATLUN, *) ELEMID

C      WRITE THE PATH DATA INTO THE DATA STRUCTURE
       WRITE(DATLUN, *) PATH


       RETURN
       END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M M T C H
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
```

```
C MODULE  : _
C=============================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=============================================================================
C CALLING SEQUENCE:
C     CALL CMMTCH (HEIGHT)
C=============================================================================
C INPUT PARAMETERS:
C     HEIGHT - REAL - CHARACTER HEIGHT
C=============================================================================
C OUTPUT PARAMETERS:
C
C=============================================================================
C COMMON INPUTS:
C     DATSTR
C=============================================================================
C COMMON OUTPUTS:
C     NONE
C=============================================================================
C LOCAL VARIABLES:
C
C=============================================================================
C FUNCTIONAL DESCRIPTION:
C     1051 - CADMADE SET MENU TITLE CHARACTER HEIGHT
C=============================================================================
C MODULES CALLED:
C
C=============================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (20:00:32)
C=============================================================================
C=============================================================================

      SUBROUTINE CMMTCH (HEIGHT)

      REAL HEIGHT

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1051)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE HEIGHT DATA INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) HEIGHT

      RETURN
      END

C=============================================================================
C                          C A D M A D E  M O D U L E  C M M T C S
C=============================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  : _
C=============================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=============================================================================
C CALLING SEQUENCE:
C     CALL CMMTCS (SPACE)
C=============================================================================
C INPUT PARAMETERS:
C     SPACE - REAL - CHARACTER SPACING
C=============================================================================
C OUTPUT PARAMETERS:
C
C=============================================================================
C COMMON INPUTS:
C     DATSTR
C=============================================================================
C COMMON OUTPUTS:
C     NONE
C=============================================================================
C LOCAL VARIABLES:
C
C=============================================================================
C FUNCTIONAL DESCRIPTION:
C     1052 - CADMADE SET MENU TITLE CHARACTER SPACING
C=============================================================================
C MODULES CALLED:
C
C=============================================================================
C CODED BY:  SANKAR JAYARAM
```

```
C     DATE:  02/18/89 (19:57:11)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMTCS (SPACE)

      REAL SPACE

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1052)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE SPACING DATA INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) SPACE

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M M T X P
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMTXP (EXPANS)
C=====================================================================
C INPUT PARAMETERS:
C     EXPANS - REAL - CHARACTER EXPANSION FACTOR
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1053 - CADMADE SET MENU TITLE CHARACTER EXPANSION FACTOR
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:56:04)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMTXP (EXPANS)

      REAL EXPANS

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1053)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE EXPANSION FACTOR INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) EXPANS

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M M T A L
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
```

```
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMTAL (HORIZ, VERT)
C=====================================================================
C INPUT PARAMETERS:
C     HORIZ - INTEGER - HORIZONTAL ALIGNMENT
C     VERT  - INTEGER - VERTICAL ALIGNMENT
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1054 - CADMADE SET MENU TITLE TEXT ALIGNMENT
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:55:21)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMTAL (HORIZ, VERT)

      INTEGER HORIZ, VERT

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1054)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE ALIGNMENT INDICATORS INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) HORIZ, VERT

      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M M T C I
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMTCI (COLOR)
C=====================================================================
C INPUT PARAMETERS:
C     COLOR - INTEGER - COLOR INDEX
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1055 - CADMADE SET MENU TITLE TEXT COLOR INDEX
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:54:17)
```

```
C=====================================================================
C=====================================================================

      SUBROUTINE CMMTCI (COLOR)

      INTEGER COLOR

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1055)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE COLOR INDEX INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) COLOR

      RETURN
      END

C=====================================================================
C                        C A D M A D E  M O D U L E  C M M T F O
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMTFO (FONT)
C=====================================================================
C INPUT PARAMETERS:
C     FONT - INTEGER - TEXT FONT
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1057 - CADMADE SET MENU TITLE TEXT FONT
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:52:22)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMTFO (FONT)

      INTEGER FONT

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1057)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE FONT ID INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) FONT

      RETURN
      END

C=====================================================================
C                        C A D M A D E  M O D U L E  C M M T T I
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
```

```
C CALLING SEQUENCE:
C     CALL CMMTTI (INDEX)
C=======================================================================
C INPUT PARAMETERS:
C     INDEX - INTEGER - ATTRIBUTE INDEX
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1058 - CADMADE SET MENU TITLE TEXT INDEX
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:51:03)
C=======================================================================
C=======================================================================

      SUBROUTINE CMMTTI (INDEX)

      INTEGER INDEX

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1058)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE INDEX INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) INDEX

      RETURN
      END

C=======================================================================
C                          C A D M A D E  M O D U L E  C M M T P R
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMTPR (PREC)
C=======================================================================
C INPUT PARAMETERS:
C     PREC - INTEGER - TEXT PRECISION
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1059 - CADMADE SET MENU TITLE TEXT PRECISION
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:49:58)
C=======================================================================
C=======================================================================
```

```
      SUBROUTINE CMMTPR (PREC)

      INTEGER PREC

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1059)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE PRECISION INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) PREC

      RETURN
      END

C=======================================================================
C                          C A D M A D E   M O D U L E   C M M T U P
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMTUP (CHUX, CHUY)
C=======================================================================
C INPUT PARAMETERS:
C     CHUX - REAL - CHARACTER UP VECTOR X COMPONENT
C     CHUY - REAL - CHARACTER UP VECTOR Y COMPONENT
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1060 - CADMADE SET MENU TITLE CHARACTER UP VECTOR
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:49:09)
C=======================================================================
C=======================================================================

      SUBROUTINE CMMTUP (CHUX, CHUY)

      REAL CHUX, CHUY

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1060)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE CHARACTER UP VECTOR INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) CHUX, CHUY

      RETURN
      END

C=======================================================================
C                          C A D M A D E   M O D U L E   C M M T B F
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMTBF (FLAG)
```

```
C=====================================================================
C INPUT PARAMETERS:
C     FLAG - INTEGER - AREA BACKGROUND FLAG
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1061 - CADMADE SET MENU TITLE AREA BACKGROUND FLAG
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:47:40)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMTBF (FLAG)

      INTEGER FLAG

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1061)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE AREA BACKGROUND FLAG INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) FLAG

      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M M T O F
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMTOF (FLAG)
C=====================================================================
C INPUT PARAMETERS:
C     FLAG - INTEGER - AREA OUTLINE FLAG
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1062 - CADMADE SET MENU TITLE AREA OUTLINE FLAG
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:46:27)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMTOF (FLAG)
```

```
      INTEGER FLAG

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1062)

      WRITE(DATLUN, *) ELEMID

C     WRITE AREA OUTLINE FLAG INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) FLAG

      RETURN
      END

C=======================================================================
C                          C A D M A D E   M O D U L E   C M M T B C
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMTBC (COLOR)
C=======================================================================
C INPUT PARAMETERS:
C     COLOR - INTEGER - AREA BACKGROUND COLOR INDEX
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1063 - CADMADE SET MENU TITLE AREA BACKGROUND COLOR INDEX
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:45:30)
C=======================================================================
C=======================================================================

      SUBROUTINE CMMTBC (COLOR)

      INTEGER COLOR

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1063)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE AREA BACKGROUND COLOR INDEX INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) COLOR

      RETURN
      END

C=======================================================================
C                          C A D M A D E   M O D U L E   C M M T O C
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMTOC (COLOR)
C=======================================================================
C INPUT PARAMETERS:
C     COLOR - INTEGER - AREA OUTLINE COLOR INDEX
```

```
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1064 - CADMADE SET MENU TITLE AREA OUTLINE COLOR INDEX
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:42:54)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMTOC (COLOR)

      INTEGER COLOR

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1064)

      WRITE(DATLUN, *) ELEMID

C     WRITE AREA OUTLINE COLOR INDEX INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) COLOR

      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M M T B S
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMTBS (STYLE)
C=====================================================================
C INPUT PARAMETERS:
C     STYLE - INTEGER - AREA BACKGROUND INTERIOR STYLE
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1065 - CADMADE SET MENU TITLE AREA BACKGROUND INTERIOR STYLE
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:59:59)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMTBS (STYLE)

      INTEGER STYLE

      INTEGER ELEMID, DATLUN
```

```
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1065)

      WRITE(DATLUN, *) ELEMID

C     WRITE AREA BACKGROUND INTERIOR STYLE INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) STYLE

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M M T B I
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMTBI (INDEX)
C=====================================================================
C INPUT PARAMETERS:
C     INDEX - INTEGER - AREA BACKGROUND INTERIOR STYLE INDEX
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1066 - CADMADE SET MENU TITLE AREA BACKGROUND INTERIOR STYLE INDEX
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:58:43)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMTBI (INDEX)

      INTEGER INDEX

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1066)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE AREA BACKGROUND INTERIOR STYLE INDEX TO THE DATA
C     STRUCTURE
      WRITE(DATLUN, *) INDEX

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M M T O T
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMTOT (TYPE)
C=====================================================================
C INPUT PARAMETERS:
C     TYPE - INTEGER - AREA OUTLINE LINE TYPE
C=====================================================================
C OUTPUT PARAMETERS:
```

```
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1067 - CADMADE SET MENU TITLE AREA OUTLINE LINE TYPE
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:56:55)
C=======================================================================
C=======================================================================

      SUBROUTINE CMMTOT (TYPE)

      INTEGER TYPE

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1067)

      WRITE(DATLUN, *) ELEMID

C     WRITE AREA OUTLINE LINE TYPE TO THE DATA STRUCTURE
      WRITE(DATLUN, *) TYPE

      RETURN
      END

C=======================================================================
C                          C A D M A D E  M O D U L E  C M M T O W
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMTOW (WIDTH)
C=======================================================================
C INPUT PARAMETERS:
C     WIDTH - REAL - AREA OUTLINE WIDTH FACTOR
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1068 - CADMADE SET MENU TITLE AREA OUTLINE WIDTH FACTOR
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:56:08)
C=======================================================================
C=======================================================================

      SUBROUTINE CMMTOW (WIDTH)

      REAL WIDTH

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1068)
```

```
      WRITE(DATLUN, *) ELEMID

C     WRITE AREA OUTLINE WIDTH FACTOR TO THE DATA STRUCTURE
      WRITE(DATLUN, *) WIDTH

      RETURN
      END
C=======================================================================
C                          C A D M A D E  M O D U L E  C M M I C P
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMICP (PATH)
C=======================================================================
C INPUT PARAMETERS:
C     PATH - INTEGER - MENU ITEM TEXT PATH
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1070 - CADMADE SET MENU ITEM TEXT PATH
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (20:01:38)
C=======================================================================
C=======================================================================

      SUBROUTINE CMMICP (PATH)

      INTEGER PATH

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1070)

      WRITE(DATLUN, *) ELEMID

C     WRITE MENU ITEM TEXT PATH TO THE DATA STRUCTURE
      WRITE(DATLUN, *) PATH

      RETURN
      END

C=======================================================================
C                          C A D M A D E  M O D U L E  C M M I C H
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMICH (HEIGHT)
C=======================================================================
C INPUT PARAMETERS:
C     HEIGHT - REAL - MENU ITEM CHARACTER HEIGHT
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
```

```
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1071 - CADMADE SET MENU ITEM CHARACTER HEIGHT
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (20:00:32)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMICH (HEIGHT)

      REAL HEIGHT

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1071)

      WRITE(DATLUN, *) ELEMID

C     WRITE MENU ITEM CHARACTER HEIGHT TO THE DATA STRUCTURE
      WRITE(DATLUN, *) HEIGHT

      RETURN
      END

C=====================================================================
C                        C A D M A D E  M O D U L E  C M M I C S
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMICS (SPACE)
C=====================================================================
C INPUT PARAMETERS:
C     SPACE - REAL - MENU ITEM CHARACTER SPACING
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1072 - CADMADE SET MENU ITEM CHARACTER SPACING
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:57:11)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMICS (SPACE)

      REAL SPACE

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1072)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE SPACING DATA INTO A DATA STRUCTURE
```

```
      WRITE(DATLUN, *) SPACE

      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M M I X P
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMIXP (EXPANS)
C=====================================================================
C INPUT PARAMETERS:
C     EXPANS - REAL - CHARACTER EXPANSION FACTOR
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1073 - CADMADE SET MENU ITEM CHARACTER EXPANSION FACTOR
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:56:04)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMIXP (EXPANS)

      REAL EXPANS

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1073)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE EXPANSION FACTOR INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) EXPANS

      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M M I A L
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMIAL (HORIZ, VERT)
C=====================================================================
C INPUT PARAMETERS:
C     HORIZ - INTEGER - HORIZONTAL ALIGNMENT
C     VERT  - INTEGER - VERTICAL ALIGNMENT
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
```

```
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1074 - CADMADE SET MENU ITEM TEXT ALIGNMENT
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:55:21)
C=======================================================================
C=======================================================================

      SUBROUTINE CMMIAL (HORIZ, VERT)

      REAL HORIZ, VERT

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1074)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE ALIGNMENT INDICATORS INTO THE MENU STRUCTURE
      WRITE(DATLUN, *) HORIZ, VERT

      RETURN
      END

C=======================================================================
C                          C A D M A D E  M O D U L E  C M M I C I
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMICI (COLOR)
C=======================================================================
C INPUT PARAMETERS:
C     COLOR - INTEGER - COLOR INDEX
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1075 - CADMADE SET MENU ITEM TEXT COLOR INDEX
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:54:17)
C=======================================================================
C=======================================================================

      SUBROUTINE CMMICI (COLOR)

      INTEGER COLOR

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1075)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE COLOR INDEX INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) COLOR
```

```
      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M M I F O
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMIFO (FONT)
C=====================================================================
C INPUT PARAMETERS:
C     FONT - INTEGER - TEXT FONT
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1077 - CADMADE SET MENU ITEM TEXT FONT
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:52:22)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMIFO (FONT)

      INTEGER FONT

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1077)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE FONT ID INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) FONT

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M M I T I
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMITI (INDEX)
C=====================================================================
C INPUT PARAMETERS:
C     INDEX - INTEGER - TEXT ATTRIBUTE INDEX
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
```

```
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1078 - CADMADE SET MENU ITEM TEXT INDEX
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:51:03)
C=======================================================================
C=======================================================================

      SUBROUTINE CMMITI (INDEX)

      INTEGER INDEX

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1078)

      WRITE(DATLUN, *) ELEMID

C     WRITE REXT INDEX ID TO DATA STRUCTURE
      WRITE(DATLUN, *) INDEX

      RETURN
      END

C=======================================================================
C                          C A D M A D E  M O D U L E  C M M I P R
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMIPR (PREC)
C=======================================================================
C INPUT PARAMETERS:
C     PREC - INTEGER - TEXT PRECISION
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1079 - CADMADE SET MENU ITEM TEXT PRECISION
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:49:58)
C=======================================================================
C=======================================================================

      SUBROUTINE CMMIPR (PREC)

      INTEGER PREC

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1079)

      WRITE(DATLUN, *) ELEMID

C     WRITE TEXT PRECISION INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) PREC

      RETURN
      END
```

```
C=====================================================================
C                          C A D M A D E  M O D U L E  C M M I U P
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMIUP (CHUX, CHUY)
C=====================================================================
C INPUT PARAMETERS:
C     CHUX - REAL - CHARACTER UP VECTOR X COMPONENT
C     CHUY - REAL - CHARACTER UP VECTOR Y COMPONENT
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1080 - CADMADE SET MENU ITEM CHARACTER UP VECTOR
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:49:09)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMIUP (CHUX, CHUY)

      REAL CHUX, CHUY

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1080)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE CHARACTER UP VECTOR INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) CHUX, CHUY

      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M M I B F
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMIBF (FLAG)
C=====================================================================
C INPUT PARAMETERS:
C     FLAG - INTEGER - AREA BACKGROUND FLAG
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
```

```
C FUNCTIONAL DESCRIPTION:
C     1081 - CADMADE SET MENU ITEM AREA BACKGROUND FLAG
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:47:40)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMIBF (FLAG)

      INTEGER FLAG

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1081)

      WRITE(DATLUN, *) ELEMID

C     WRITE AREA BACKGROUND FLAG TO THE DATA STRUCTURE
      WRITE(DATLUN, *) FLAG

      RETURN
      END

C=====================================================================
C                        C A D M A D E  M O D U L E  C M M I O F
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMIOF (FLAG)
C=====================================================================
C INPUT PARAMETERS:
C     INTEGER FLAG
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1082 - CADMADE SET MENU ITEM AREA OUTLINE FLAG
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:46:27)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMIOF (FLAG)

      INTEGER FLAG

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1082)

      WRITE(DATLUN, *) ELEMID

C     WRITE BACKGROUND AREA FLAG INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) FLAG

      RETURN
      END

C=====================================================================
C                        C A D M A D E  M O D U L E  C M M I B C
```

```
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMIBC (COLOR)
C=====================================================================
C INPUT PARAMETERS:
C     COLOR - INTEGER - BACKGROUND COLOR INDEX
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1083 - CADMADE SET MENU ITEM AREA BACKGROUND COLOR INDEX
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:45:30)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMIBC (COLOR)

      INTEGER COLOR

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1083)

      WRITE(DATLUN, *) ELEMID

C     WRITE BACKGROUND COLOR INDEX INTO A DATA STRUCTURE
      WRITE(DATLUN, *) COLOR

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M M I O C
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMIOC (COLOR)
C=====================================================================
C INPUT PARAMETERS:
C     COLOR - INTEGER - AREA OUTLINE COLOR INDEX
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     1084 - CADMADE SET MENU ITEM AREA OUTLINE COLOR INDEX
C=====================================================================
```

```
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:42:54)
C=======================================================================
C=======================================================================

      SUBROUTINE CMMIOC (COLOR)

      INTEGER COLOR

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1084)

      WRITE(DATLUN, *) ELEMID

C     WRITE AREA OUTLINE COLOR INDEX INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) COLOR

      RETURN
      END

C=======================================================================
C                          C A D M A D E   M O D U L E   C M M I B S
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C    PART  :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMIBS (STYLE)
C=======================================================================
C INPUT PARAMETERS:
C     STYLE - INTEGER - AREA BACKGROUND INTERIOR STYLE
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     1085 - CADMADE SET MENU ITEM AREA BACKGROUND INTERIOR STYLE
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:59:59)
C=======================================================================
C=======================================================================

      SUBROUTINE CMMIBS (STYLE)

      INTEGER STYLE

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1085)

      WRITE(DATLUN, *) ELEMID

C     WRITE AREA BACKGROUND INTERIOR STYLE INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) STYLE

      RETURN
      END

C=======================================================================
C                          C A D M A D E   M O D U L E   C M M I B I
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
```

```
C   PART  :  UIE-___
C MODULE  :  _
C=============================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=============================================================================
C CALLING SEQUENCE:
C     CALL CMMIBI (INDEX)
C=============================================================================
C INPUT PARAMETERS:
C     INDEX - INTEGER - BACKGROUND INTERIOR STYLE INDEX
C=============================================================================
C OUTPUT PARAMETERS:
C
C=============================================================================
C COMMON INPUTS:
C     DATSTR
C=============================================================================
C COMMON OUTPUTS:
C     NONE
C=============================================================================
C LOCAL VARIABLES:
C
C=============================================================================
C FUNCTIONAL DESCRIPTION:
C     1086 - CADMADE SET MENU ITEM AREA BACKGROUND INTERIOR STYLE INDEX
C=============================================================================
C MODULES CALLED:
C
C=============================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:58:43)
C=============================================================================
C=============================================================================

      SUBROUTINE CMMIBI (INDEX)

      INTEGER STYLE

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1086)

      WRITE(DATLUN, *) ELEMID

C     WRITE BACKGROUND INTERIOR STYLE INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) INDEX

      RETURN
      END

C=============================================================================
C                          C A D M A D E  M O D U L E  C M M I O T
C=============================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=============================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=============================================================================
C CALLING SEQUENCE:
C     CALL CMMIOT (TYPE)
C=============================================================================
C INPUT PARAMETERS:
C     TYPE - INTEGER - AREA OUTLINE LINE TYPE
C=============================================================================
C OUTPUT PARAMETERS:
C
C=============================================================================
C COMMON INPUTS:
C     DATSTR
C=============================================================================
C COMMON OUTPUTS:
C     NONE
C=============================================================================
C LOCAL VARIABLES:
C
C=============================================================================
C FUNCTIONAL DESCRIPTION:
C     1087 - CADMADE SET MENU ITEM AREA OUTLINE LINE TYPE
C=============================================================================
C MODULES CALLED:
C
C=============================================================================
```

```
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:56:55)
C=================================================================
C=================================================================

      SUBROUTINE CMMIOT (TYPE)

      INTEGER TYPE

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1087)

      WRITE(DATLUN, *) ELEMID

C     WRITE AREA OUTLINE LINE TYPE TO THE DATA STRUCTURE
      WRITE(DATLUN, *) TYPE

      RETURN
      END

C=================================================================
C                          C A D M A D E  M O D U L E  C M M I O W
C=================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=================================================================
C CALLING SEQUENCE:
C     CALL CMMIOW (WIDTH)
C=================================================================
C INPUT PARAMETERS:
C     WIDTH - REAL - AREA OUTLINE WIDTH FACTOR
C=================================================================
C OUTPUT PARAMETERS:
C
C=================================================================
C COMMON INPUTS:
C     NONE
C=================================================================
C COMMON OUTPUTS:
C     NONE
C=================================================================
C LOCAL VARIABLES:
C
C=================================================================
C FUNCTIONAL DESCRIPTION:
C     1088 - CADMADE SET MENU ITEM AREA OUTLINE WIDTH FACTOR
C=================================================================
C MODULES CALLED:
C
C=================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:56:08)
C=================================================================
C=================================================================

      SUBROUTINE CMMIOW (WIDTH)

      REAL WIDTH

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1088)

      WRITE(DATLUN, *) ELEMID

C     WRITE AREA OUTLINE WIDTH FACTOR INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) WIDTH

      RETURN
      END

C=================================================================
C                          C A D M A D E  M O D U L E  C M M P D A
C=================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=================================================================
```

```
C COMPILER:  FORTVS2 (FORTRAN 77)
C=================================================================
C CALLING SEQUENCE:
C     CALL CMMPDA (DLGID)
C=================================================================
C INPUT PARAMETERS:
C     DLGID - INTEGER - DIALOG AREA IDENTIFIER
C=================================================================
C OUTPUT PARAMETERS:
C
C=================================================================
C COMMON INPUTS:
C     DATSTR
C=================================================================
C COMMON OUTPUTS:
C     NONE
C=================================================================
C LOCAL VARIABLES:
C
C=================================================================
C FUNCTIONAL DESCRIPTION:
C     1091 - CADMADE SET MENU PROMPT DIALOGUE IDENTIFIER
C=================================================================
C MODULES CALLED:
C
C=================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:18:16)
C=================================================================
C=================================================================

      SUBROUTINE CMMPDA (DLGID)

      INTEGER DLGID

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1091)

      WRITE(DATLUN, *) ELEMID

C     WRITE MENU PROMPT DIALOGUE IDENTIFIER TO THE DATA STRUCTURE
      WRITE(DATLUN, *) DLGID

      RETURN
      END


C=================================================================
C                          C A D M A D E   M O D U L E   C M M P S T
C=================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=================================================================
C CALLING SEQUENCE:
C     CALL CMMPST (LENGTH, STRING)
C=================================================================
C INPUT PARAMETERS:
C     LENGTH - INTEGER - PROMPT STRING LENGTH
C     STRING - CHARACTER*(*) - PROMPT STRING
C=================================================================
C OUTPUT PARAMETERS:
C
C=================================================================
C COMMON INPUTS:
C     DATSTR
C=================================================================
C COMMON OUTPUTS:
C     NONE
C=================================================================
C LOCAL VARIABLES:
C
C=================================================================
C FUNCTIONAL DESCRIPTION:
C     1092 - CADMADE SET MENU PROMPT STRING
C=================================================================
C MODULES CALLED:
C
C=================================================================
C CODED BY:  SANKAR JAYARAM
```

```
C     DATE:  02/18/89 (18:16:51)
C=====================================================================
C=====================================================================

      SUBROUTINE CMMPST (LENGTH, STRING)

      INTEGER LENGTH
      CHARACTER STRING*(*)

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 1092)

      WRITE(DATLUN, *) ELEMID

C     WRITE MENU PROMPT STRING INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) LENGTH
      WRITE(DATLUN, '(A)') STRING

      RETURN
      END



C=====================================================================
C                       M O D U L E  E R R M S G
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL ERRMSG (NAME, MSG)
C=====================================================================
C INPUT PARAMETERS:
C     NAME - CHARACTER*(*) - NAME OF THE ROUTINE WHERE ERROR OCCURRED
C     MSG  - CHARACTER*(*) - ERROR MESSAGE
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE WRITE ERROR MESSAGE TO ERROR FILE
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/04/89 (09:09:08)
C=====================================================================

      SUBROUTINE ERRMSG (NAME, MSG)

      CHARACTER*(*) NAME, MSG

      INTEGER NOUT
      PARAMETER(NOUT = 90)

C     WRITE ERROR MESSAGE TO CONSOLE
      WRITE(NOUT,*)'ERROR (',NAME,') --> ',MSG,'.'

      RETURN
      END

C=====================================================================
C                       C A D M A D E  M O D U L E  C M W A I T
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
```

```
C MODULE  :
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMWAIT (TIME, WKID, ICL, IDNR)
C=======================================================================
C INPUT PARAMETERS:
C     TIME - REAL    - TIME OUT (SECONDS)
C     WKID - INTEGER - WORKSTATION IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C     ICL  - INTEGER - EVENT INPUT DEVICE CLASS
C     IDNR - INTEGER - EVENT INPUT DEVICE NUMBER
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     CMPICK, CMSTRN, CMSTR1
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE AWAIT EVENT
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/06/89 (12:40:05)
C=======================================================================

      SUBROUTINE CMWAIT (TIME, WKID, ICL, IDNR)

      INTEGER WKID, ICL, IDNR
      REAL TIME

      INTEGER PICKCL, MENUCL, STRNCL
      PARAMETER (PICKCL = 5, STRNCL = 6, MENUCL = 7)

      INTEGER NDEP
      PARAMETER (NDEP = 16)
      INTEGER ISTAT1, PPD1, PP1(3,NDEP)
      COMMON /CMPICK/ ISTAT1, PPD1, PP1

      CHARACTER*80 STRING
      INTEGER LOSTR
      COMMON /CMSTRN/ LOSTR
      COMMON /CMSTR1/ STRING

      CHARACTER*80 STRIN1

C     CALL PHIGS AWAIT EVENT
100   CALL PWAIT (TIME, WKID, ICL, IDNR)

      IF (ICL .EQ. PICKCL) THEN

C        IF THE EVENT WAS A PICK, GET THE PICK EVENT
         CALL PGTHP (NDEP, ISTAT1, PPD1, PP1)

C        CHECK THE PICK STATUS
         IF (ISTAT1 .EQ. 0) THEN

C             CHECK THE PICK TO SEE IF IT WAS A MENU PICK
              IF (PP1(1,1) .GE. 10000 .AND. PP1(1,1) .LE. 90000) THEN

C                  SET THE CLASS TO MENU PICK
                   ICL = MENUCL

              ENDIF

         ENDIF

      ENDIF

      IF (ICL .EQ. STRNCL) THEN

C        IF THE EVENT WAS A STRING, GET THE STRING EVENT
         CALL PGTST (LOSTR, STRING)

C        CHECK THE STRING TO CHECK THE FIRST CHARACTER
         IF (STRING (1:1) .EQ. '$') THEN
```

```
C             STRIP OUT THE FIRST CHARACTER
              STRIN1(1:LOSTR-1) = STRING(2:LOSTR)

C             EXECUTE SYSTEM COMMAND
              CALL SYSCAL (STRIN1, LOSTR-1, IER)

C             CLEAR THE SCREEN
              CALL SYSCAL ('CLEAR', 5, IER)

C             ADD THE STRING TO THE MESSAGES FOR ECHO
              CALL CMMSG (WKID, 1, STRING)

C             UPDATE THE WORKSTATION
              CALL PUWK (WKID, 1)

C             GO BACK TO AWAIT EVENT
              GO TO 100

          ENDIF

C         ADD THE STRING TO THE MESSAGES
          CALL CMMSG (WKID, 1, STRING)

C         UPDATE THE WORKSTATION
          CALL PUWK (WKID, 1)

        ENDIF


        RETURN
        END

C=======================================================================
C                          C A D M A D E  M O D U L E  C M G T H P
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C    PART  :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMGTHP (NDEPTH, ISTAT, PPD, PP)
C=======================================================================
C INPUT PARAMETERS:
C     NDEPTH - INTEGER - DEPTH OF PICK PATH TO BE RETURNED
C=======================================================================
C OUTPUT PARAMETERS:
C     ISTAT  - INTEGER - PICK STATUS
C     PPD    - INTEGER - PICK DEPTH RETURNED
C     PP(3,*)- INTEGER - PICK PATH
C=======================================================================
C COMMON INPUTS:
C     CMPICK
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE GET HIERARCHICAL PICK
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/06/89 (14:14:51)
C=======================================================================

      SUBROUTINE CMGTHP (NDEPTH, ISTAT, PPD, PP)

      INTEGER NDEPTH, ISTAT, PPD, PP(3,*)

      INTEGER NDEP
      PARAMETER (NDEP = 16)
      INTEGER ISTAT1, PPD1, PP1(3,NDEP)
      COMMON /CMPICK/ ISTAT1, PPD1, PP1

C     RETURN THE PICK PARAMETERS
```

```
      ISTAT = ISTAT1
      PPD = PPD1

      DO 100 IP = 1,NDEPTH

         PP(1,IP) = PP1(1,IP)
         PP(2,IP) = PP1(2,IP)
         PP(3,IP) = PP1(3,IP)

100   CONTINUE

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M G T S T
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMGTST (LOSTR, STRING)
C=====================================================================
C INPUT PARAMETERS:
C
C=====================================================================
C OUTPUT PARAMETERS:
C     LOSTR - INTEGER - LENGTH OF STRING RETURNED
C     STRING- CHARACTER*(*) - STRING RETURNED
C=====================================================================
C COMMON INPUTS:
C     CMSTRN, CMSTR1
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE GET STRING
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/06/89 (14:14:51)
C=====================================================================

      SUBROUTINE CMGTST (LOST, STR)

      CHARACTER*(*) STR
      INTEGER LOST

      CHARACTER*80 STRING
      INTEGER LOSTR
      COMMON /CMSTRN/ LOSTR
      COMMON /CMSTR1/ STRING

      LOST = LOSTR
      STR(1:LOSTR) = STRING(1:LOSTR)

      RETURN
      END



C=====================================================================
C                          C A D M A D E   M O D U L E   C M C M R T
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
```

```
C CALLING SEQUENCE:
C     CALL CMCMRT (MENUID)
C=======================================================================
C INPUT PARAMETERS:
C     MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     PHGSTR
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE CREATE MENU ROOT
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/04/89 (08:46:56)
C=======================================================================

      SUBROUTINE CMCMRT (MENUID)

      INTEGER MENUID

      INTEGER PHRT, IER

      INTEGER NXTSTR
      COMMON /PHGSTR/ NXTSTR

C     GET THE PHIGS ROOT STRUCTURE ID
      CALL GTPHRT (MENUID, PHRT, IER)

C     SET THE PHIGS STRUCTURE ID IN THE COMMON BLOCK
      NXTSTR = PHRT

C     SEARCH THE MENU DATA STRUCTURE AND FIND THE ROOT MENU STRUCTURE
      CALL FNDMRT (MENUID, PHRT)

C     CREATE THE PHIGS STRUCTURES FOR THE ROOT MENU
      CALL CRPHRT (MENUID, PHRT)

C     CLEAR THE MENU ATTRIBUTES AND RESTORE THE DEFAULT VALUES
      CALL CLMNAT

      RETURN
      END

C=======================================================================
C                    M O D U L E  C L M N A T
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CLMNAT
C=======================================================================
C INPUT PARAMETERS:
C
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     MNUATT, MNUAT1
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
```

```
C     CADMADE CLEAR  CURRENT MENU ATTRIBUTE SETTINGS
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/05/89 (13:45:30)
C=====================================================================

      SUBROUTINE CLMNAT

**************************************************
C START OF COMMON BLOCK FOR SAVING MENU ATTRIBUTES
**************************************************
      INTEGER NATT

      INTEGER MAXN, MAXITM

      PARAMETER (MAXN = 50, MAXITM = 20)

      INTEGER TPATH(MAXN), THAL(MAXN), TVAL(MAXN), TCI(MAXN),
     >        TFONT(MAXN), TIND(MAXN), TPREC(MAXN), TBFLAG(MAXN),
     >        TOFLAG(MAXN), TBCI(MAXN), TOCI(MAXN), TBS(MAXN),
     >        TBSI(MAXN), TOLT(MAXN),

     >        IPATH(MAXN), IHAL(MAXN), IVAL(MAXN), ICI(MAXN),
     >        IFONT(MAXN), IIND(MAXN), IPREC(MAXN), IBFLAG(MAXN),
     >        IOFLAG(MAXN), IBCI(MAXN), IOCI(MAXN), IBS(MAXN),
     >        IBSI(MAXN), IOLT(MAXN),

     >        DLOGID(MAXN), PRMTLN(MAXN)

      REAL THT(MAXN), TSPACE(MAXN), TEXPAN(MAXN), TUPX(MAXN),TUPY(MAXN),
     >     TOW(MAXN), TXLOC(MAXN), TYLOC(MAXN),
     >     IHT(MAXN), ISPACE(MAXN), IEXPAN(MAXN), IUPX(MAXN),IUPY(MAXN),
     >     IOW(MAXN), IXLOC(MAXITM, MAXN), IYLOC(MAXITM, MAXN)

      CHARACTER*80 PROMPT(MAXN)

      COMMON /MNUATT/ NATT,
     >        TPATH, THAL, TVAL, TCI, TFONT, TIND, TPREC, TBFLAG,
     >        TOFLAG, TBCI, TOCI, TBS, TBSI, TOLT,
     >        IPATH, IHAL, IVAL, ICI, IFONT, IIND, IPREC, IBFLAG,
     >        IOFLAG, IBCI, IOCI, IBS, IBSI, IOLT,
     >        DLOGID, PRMTLN,
     >        THT, TSPACE, TEXPAN, TUPX, TUPY, TOW, TXLOC, TYLOC,
     >        IHT, ISPACE, IEXPAN, IUPX, IUPY, IOW, IXLOC, IYLOC
      COMMON /MNUAT1/ PROMPT
**********************
C END OF COMMON BLOCK
**********************

C     SET THE NUMBER OF WAITING ATTRIBUTE LISTS
      NATT = 1

C     RESET THE CURRENT ATTRIBUTES

         TPATH (1)  = 0
         THAL (1)   = 2
         TVAL (1)   = 3
         TCI (1)    = 1
         TFONT (1)  = 2
         TIND (1)   = 1
         TPREC (1)  = 1
         TBFLAG (1) = 1
         TOFLAG (1) = 1
         TBCI (1)   = 0
         TOCI (1)   = 1
         TBS (1)    = 1
         TBSI (1)   = 1
         TOLT (1)   = 1

         IPATH (1)  = 0
         IHAL (1)   = 2
         IVAL (1)   = 3
         ICI (1)    = 3
         IFONT (1)  = 2
         IIND (1)   = 1
         IPREC (1)  = 1
         IBFLAG (1) = 1
         IOFLAG (1) = 1
         IBCI (1)   = 0
         IOCI (1)   = 3
         IBS (1)    = 1
```

```
          IBSI (1)   = 1
          IOLT (1)   = 1

          DLOGID (1) = 1
          PRMTLN (1) = 14

          THT (1)    = 0.03
          TSPACE (1) = 1.0
          TEXPAN (1) = 1.0
          TUPX (1)   = 0.0
          TUPY (1)   = 1.0
          TOW (1)    = 1.0
          TXLOC (1)  = 0.7
          TYLOC (1)  = 0.85
          IHT (1)    = 0.02
          ISPACE (1) = 1.0
          IEXPAN (1) = 1.0
          IUPX (1)   = 0.0
          IUPY (1)   = 1.0
          IOW (1)    = 1.0

          PROMPT (1) = 'PICK MENU ITEM'

          DO 50 ITEM = 1, MAXITM

               IXLOC(ITEM, 1) = 0.7
               IYLOC(ITEM, 1) = 0.725 - FLOAT(ITEM-1)*0.1

50        CONTINUE

100    CONTINUE

       RETURN
       END

C=======================================================================
C                    M O D U L E   G T P H R T
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL GTPHRT (MENUID, PHRT, IER)
C=======================================================================
C INPUT PARAMETERS:
C     MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C     PHRT   - INTEGER - PHIGS ROOT STRUCTURE IDENTIFIER
C     IER    - INTEGER - ERROR INDICATOR
C=======================================================================
C COMMON INPUTS:
C     MNPHRT
C=======================================================================
C COMMON OUTPUTS:
C     MNPHRT
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE GET PHIGS ROOT STRUCTURE ID FOR ROOT MENU
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/04/89 (08:51:53)
C=======================================================================

       SUBROUTINE GTPHRT (MENUID, PHRT, IER)

       INTEGER MENUID, PHRT, IER

       INTEGER NROOTS

       PARAMETER (NROOTS = 9)

       INTEGER AVALRT (NROOTS,2)
```

```
      COMMON /MNPHRT/ AVALRT

C     RESET ERROR FLAG
      IER = 1

      DO 100 ICOUNT = 1, NROOTS - 1

C        CHECK TO SEE IF THE ROOT IS BEING USED
         IF (AVALRT(ICOUNT,1) .EQ. 0) THEN

C              IF THE ROOT IS AVAILABLE, TAKE IT
               AVALRT (ICOUNT,1) = 1

C              ASSOCIATE THE MENUID WITH THE PHIGS ROOT
               AVALRT(ICOUNT,2) = MENUID

C              RETURN THE CORRESPONDING PHIGS ROOT
               PHRT = 1000*ICOUNT + 1

C              CLEAR THE ERROR FLAG
50             IER = 0

C              STOP THE SEARCH
               GO TO 200

         ENDIF

100   CONTINUE

C     CHECK THE ERROR FLAG
200   IF (IER .EQ. 1) THEN

C        WRITE THE ERROR MESSAGE
         CALL ERRMSG ('CMCMRT', 'GTPHRT - NO MORE ROOTS AVAILABLE')

      ENDIF

      RETURN
      END

C=======================================================================
C                        M O D U L E   F N D M R T
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL FNDMRT (MENUID, PHRT)
C=======================================================================
C INPUT PARAMETERS:
C     MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C     PHRT   - INTEGER - PHIGS ROOT STRUCTURE IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     EXMNST
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE FIND MENU ROOT STRUCTURE
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/04/89 (09:17:25)
C=======================================================================

      SUBROUTINE FNDMRT (MENUID, PHRT)

      INTEGER MENUID, PHRT

      INTEGER NST, MNPHST(100), MNST(100)
```

```
      COMMON /EXMNST/ NST, MNPHST, MNST

C     ADD THE ROOT MENU AND THE PHIGS STRUCTURE TO THE LIST OF
C     STRUCTURES WAITING TO BE CREATED AND EXECUTED

      NST = NST + 1
      MNPHST(NST) = PHRT
      MNST(NST) = MENUID

      RETURN
      END

C=====================================================================
C                        M O D U L E   F N D M S T
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL FNDMST (MENUID, IER)
C=====================================================================
C INPUT PARAMETERS:
C     MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C=====================================================================
C OUTPUT PARAMETERS:
C     IER - INTEGER - ERROR INDICATOR
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE FIND MENU STRUCTURE FROM THE MENU DATA STRUCTURE
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/04/89 (09:29:27)
C=====================================================================

      SUBROUTINE FNDMST (MENUID, IER)

      INTEGER MENUID, IER

      CHARACTER*1 CHAR

      INTEGER DATLUN
      COMMON /DATSTR/ DATLUN

C     RESET ERROR INDICATOR
      IER = 1

C     REWIND THE MENU DATA STRUCTURE FILE
      REWIND(DATLUN)

C     SEARCH THE DATA STRUCTURE AND LOCATE THE MENU STRUCTURE
      DO 100 ICOUNT = 1, 10000

C        READ THE FIRST CHARACTER
         READ (DATLUN, '(A)', END=200) CHAR

C        CHECK THE CHARACTER AND CONTINUE SEARCH IF IT IS NOT 'S'
         IF (CHAR .NE. 'S') GO TO 100

C        IF THE CHARACTER IS 'S', CHECK THE MENU STRUCTURE ID
         READ (DATLUN, *) MENU

C        IF THE MENU IDS MATCH, STOP THE SEARCH
         IF (MENU .EQ. MENUID) THEN

C             CLEAR THE ERROR INDICATOR
50           IER = 0
```

```
C              STOP THE SEARCH
               GO TO 200

            ENDIF

100    CONTINUE

200    CONTINUE

       RETURN
       END

C=======================================================================
C                        M O D U L E   C R P H R T
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C      CALL CRPHRT (MENUID, PHRT)
C=======================================================================
C INPUT PARAMETERS:
C      MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C      PHRT - INTEGER - PHIGS ROOT STRUCTURE IDENTIFIER
C=======================================================================
C COMMON INPUTS:
C      NONE
C=======================================================================
C COMMON OUTPUTS:
C      NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C      CADMADE CREATE THE PHIGS ROOT STRUCTURE FOR THE ROOT MENU
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C      DATE:  03/04/89 (10:06:52)
C=======================================================================

       SUBROUTINE CRPHRT (MENUID, PHRT)

       INTEGER MENUID, PHRT

       INTEGER ROOT, VIEWID

       PARAMETER (VIEWID = 0)

C      CALCULATE THE PHIGS ROOT STRUCTURE FOR THE MENU ROOT
       ROOT = (PHRT -1)*10

C      PHIGS OPEN STRUCTURE FOR THE PHIGS ROOT THAT WILL BE POSTED
       CALL POPST (ROOT)

C      SET THE VIEW ID FOR THE ROOT
       CALL PSVWI (VIEWID)

C      SET THE PICK ID FOR THE MENU ROOT
       CALL PSHPID (MENUID)

C      EXECUTE THE ROOT MENU PHIGS STRUCTURE
       CALL PEXST (PHRT)

C      CLOSE THE ROOT
       CALL PCLST

C      FILL ALL THE MENU STRUCTURES
       CALL FAMNST

       RETURN
       END

C=======================================================================
C                        M O D U L E   F A M N S T
```

```
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL FAMNST
C=======================================================================
C INPUT PARAMETERS:
C
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     EXMNST
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE FILL ALL MENU PHIGS STRUCTURES
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/04/89 (10:13:19)
C=======================================================================

      SUBROUTINE FAMNST

      INTEGER PHSTR, MENUID

      INTEGER NST, MNPHST(100), MNST(100)

      COMMON /EXMNST/ NST, MNPHST, MNST

C     CHECK THE WAITING LIST TO SEE IF ANY MENU STRUCTURES ARE WAITING
      IF (NST .NE. 0) THEN

C        POP THE NEXT WAITING MENU STRUCTURE
50       CALL POPEMS (PHSTR, MENUID)

C        POP THE MENU ATTRIBUTES FOR THE STRUCTURE
         CALL POPMAT

C        FILL THE MENU STRUCTURE
         CALL FLMNST (PHSTR, MENUID)

C        CHECK THE WAITING LIST AGAIN
         IF (NST .NE. 0) GO TO 50

      ENDIF

      RETURN
      END

C=======================================================================
C                      M O D U L E   P O P E M S
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL POPEMS (PHSTR, MENUID)
C=======================================================================
C INPUT PARAMETERS:
C
C=======================================================================
C OUTPUT PARAMETERS:
C     PHSTR  - INTEGER - PHIGS STRUCTURE IDENTIFIER
C     MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C=======================================================================
```

```
C COMMON INPUTS:
C     EXMNST
C=======================================================================
C COMMON OUTPUTS:
C     EXMNST
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE POP EXECUTABLE MENU STRUCTURE FROM THE WAITING LIST
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/04/89 (10:18:01)
C=======================================================================

      SUBROUTINE POPEMS (PHSTR, MENUID)

      INTEGER PHSTR, MENUID

      INTEGER NST, MNPHST(100), MNST(100)

      COMMON /EXMNST/ NST, MNPHST, MNST

C     PULL OUT THE FIRST MENU STRUCTURE
      PHSTR = MNPHST(1)
      MENUID = MNST(1)

C     MOVE THE QUEUE FORWARD
      DO 100 ICOUNT = 1, NST-1

C        MOVE THE MENUIDS AND PHIGS STRUCTURES
         MNPHST(ICOUNT) = MNPHST(ICOUNT+1)
         MNST(ICOUNT) = MNST(ICOUNT+1)

100   CONTINUE

C     DECREMENT THE NUMBER OF WAITING MENU STRUCTURES
      NST = NST - 1

      RETURN
      END

C=======================================================================
C                        M O D U L E   P O P M A T
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL POPMAT
C=======================================================================
C INPUT PARAMETERS:
C
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     MNUATT, MNUAT1
C=======================================================================
C COMMON OUTPUTS:
C     MNUATT, MNUAT1
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE POP MENU ATTRIBUTES FOR A MENU STRUCTURE
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/04/89 (10:18:01)
C=======================================================================
```

```
      SUBROUTINE POPMAT

      INTEGER PHSTR, MENUID

***********************************************
C START OF COMMON BLOCK FOR SAVING MENU ATTRIBUTES
***********************************************
      INTEGER NATT

      INTEGER MAXN, MAXITM

      PARAMETER (MAXN = 50, MAXITM = 20)

      INTEGER TPATH(MAXN), THAL(MAXN), TVAL(MAXN), TCI(MAXN),
     >        TFONT(MAXN), TIND(MAXN), TPREC(MAXN), TBFLAG(MAXN),
     >        TOFLAG(MAXN), TBCI(MAXN), TOCI(MAXN), TBS(MAXN),
     >        TBSI(MAXN), TOLT(MAXN),

     >        IPATH(MAXN), IHAL(MAXN), IVAL(MAXN), ICI(MAXN),
     >        IFONT(MAXN), IIND(MAXN), IPREC(MAXN), IBFLAG(MAXN),
     >        IOFLAG(MAXN), IBCI(MAXN), IOCI(MAXN), IBS(MAXN),
     >        IBSI(MAXN), IOLT(MAXN),

     >        DLOGID(MAXN), PRMTLN(MAXN)

      REAL THT(MAXN), TSPACE(MAXN), TEXPAN(MAXN), TUPX(MAXN),TUPY(MAXN),
     >     TOW(MAXN), TXLOC(MAXN), TYLOC(MAXN),
     >     IHT(MAXN), ISPACE(MAXN), IEXPAN(MAXN), IUPX(MAXN),IUPY(MAXN),
     >     IOW(MAXN), IXLOC(MAXITM, MAXN), IYLOC(MAXITM, MAXN)

      CHARACTER*80 PROMPT(MAXN)

      COMMON /MNUATT/ NATT,
     >        TPATH, THAL, TVAL, TCI, TFONT, TIND, TPREC, TBFLAG,
     >        TOFLAG, TBCI, TOCI, TBS, TBSI, TOLT,
     >        IPATH, IHAL, IVAL, ICI, IFONT, IIND, IPREC, IBFLAG,
     >        IOFLAG, IBCI, IOCI, IBS, IBSI, IOLT,
     >        DLOGID, PRMTLN,
     >        THT, TSPACE, TEXPAN, TUPX, TUPY, TOW, TXLOC, TYLOC,
     >        IHT, ISPACE, IEXPAN, IUPX, IUPY, IOW, IXLOC, IYLOC
      COMMON /MNUAT1/ PROMPT
**********************
C END OF COMMON BLOCK
**********************

      IF (NATT .EQ. 1) RETURN

C     MOVE THE QUEUE FORWARD
      DO 100 I = 1, NATT-1

C        MOVE THE ATTRIBUTES
         TPATH(I)  = TPATH(I+1)
         THAL(I)   = THAL(I+1)
         TVAL(I)   = TVAL(I+1)
         TCI(I)    = TCI(I+1)
         TFONT(I)  = TFONT(I+1)
         TIND(I)   = TIND(I+1)
         TPREC(I)  = TPREC(I+1)
         TBFLAG(I) = TBFLAG(I+1)
         TOFLAG(I) = TOFLAG(I+1)
         TBCI(I)   = TBCI(I+1)
         TOCI(I)   = TOCI(I+1)
         TBS(I)    = TBS(I+1)
         TBSI(I)   = TBSI(I+1)
         TOLT(I)   = TOLT(I+1)

         IPATH(I)  = IPATH(I+1)
         IHAL(I)   = IHAL(I+1)
         IVAL(I)   = IVAL(I+1)
         ICI(I)    = ICI(I+1)
         IFONT(I)  = IFONT(I+1)
         IIND(I)   = IIND(I+1)
         IPREC(I)  = IPREC(I+1)
         IBFLAG(I) = IBFLAG(I+1)
         IOFLAG(I) = IOFLAG(I+1)
         IBCI(I)   = IBCI(I+1)
         IOCI(I)   = IOCI(I+1)
         IBS(I)    = IBS(I+1)
         IBSI(I)   = IBSI(I+1)
         IOLT(I)   = IOLT(I+1)

         DLOGID(I) = DLOGID(I+1)
         PRMTLN(I) = PRMTLN(I+1)
```

```
            THT(I)     = THT(I+1)
            TSPACE(I)  = TSPACE(I+1)
            TEXPAN(I)  = TEXPAN(I+1)
            TUPX(I)    = TUPX(I+1)
            TUPY(I)    = TUPY(I+1)
            TOW(I)     = TOW(I+1)
            TXLOC(I)   = TXLOC(I+1)
            TYLOC(I)   = TYLOC(I+1)
            IHT(I)     = IHT(I+1)
            ISPACE(I)  = ISPACE(I+1)
            IEXPAN(I)  = IEXPAN(I+1)
            IUPX(I)    = IUPX(I+1)
            IUPY(I)    = IUPY(I+1)
            IOW(I)     = IOW(I+1)

            PROMPT(I) = PROMPT(I+1)

            DO 50 ITEM = 1, MAXITM

                 IXLOC(ITEM, I) = IXLOC(ITEM, I+1)
                 IYLOC(ITEM, I) = IYLOC(ITEM, I+1)

50          CONTINUE

100     CONTINUE

C       DECREMENT THE NUMBER OF WAITING ATTRIBUTE LISTS
        NATT = NATT - 1

        RETURN
        END

C=======================================================================
C                      M O D U L E   F L M N S T
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C      CALL FLMNST (PHSTR, MENUID)
C=======================================================================
C INPUT PARAMETERS:
C      PHSTR  - INTEGER - PHIGS STRUCTURE IDENTIFIER
C      MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C      NONE
C=======================================================================
C COMMON OUTPUTS:
C      NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C      CADMADE FILL MENU PHIGS STRUCUTRE
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C      DATE:  03/04/89 (10:23:52)
C=======================================================================

        SUBROUTINE FLMNST (PHSTR, MENUID)

        INTEGER PHSTR, MENUID

        INTEGER VIEWID, INVIS, VIS, NAMSET(2)

        PARAMETER (VIEWID = 0, INVIS = 126, VIS = 127)

C       FIND THE MENU STRUCTURE IN THE DATA STRUCTURE
        CALL FNDMST (MENUID, IER)

        IF (IER .EQ. 0) THEN
```

```
C         OPEN THE PHIGS STRUCTURE
          CALL POPST (PHSTR)

C         SET THE VIEW ID FOR THE PHIGS STRUCTURE
          CALL PSVWI (VIEWID)

C         SET THE MENU ID AS AN APPLICATIONS DATA IN THE PHIGS STRUCUTRE
          CALL STMIPS (MENUID)

C         REMOVE BOTH THE NAMES USED FOR MENUS FROM THE SET
          NAMSET(1) = INVIS
          NAMSET(2) = VIS

          CALL PRES (2, NAMSET)

C         ADD THE NAME FOR INVISIBILITY TO THE SET
          CALL PADS (1, INVIS)

C         FILL ALL ATTRIBUTES, PRIMITIVES ETC. FOR THE MENU STRUCUTRE
          CALL FAPMST (MENUID, PHSTR)

C         CLOSE THE PHIGS STRUCTURE
          CALL PCLST

        ENDIF

        RETURN
        END

C=======================================================================
C                       M O D U L E   S T M I P S
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL STMIPS (MENUID)
C=======================================================================
C INPUT PARAMETERS:
C     MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C     LDR - INTEGER, APPLICATION DATA RECORD LENGTH
C     DATARC(LDR) - INTEGER, APPLICATION DATA RECORD
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET MENU ID AS APPLICATIONS DATA IN PHIGS STRUCTURE
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/04/89 (10:42:47)
C=======================================================================

        SUBROUTINE STMIPS (MENUID)

        INTEGER MENUID

        INTEGER LDR, LDRBYT
        PARAMETER (LDR = 5, LDRBYT = LDR * 4)

        INTEGER DATARC(LDR)
        INTEGER PEMNI
        PARAMETER(PEMNI = 51)

        DATA DATARC / 2, 0, 0, PEMNI, 0 /

C       PUT VIEW INDEX INTO DATA RECORD
        DATARC(5) = MENUID
```

```
C     INSERT APPLICATION DATA INTO STRUCTURE
      CALL PAP (LDRBYT, DATARC)

      RETURN
      END

C=======================================================================
C                      M O D U L E   F A P M S T
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL FAPMST (MENUID, PHSTR)
C=======================================================================
C INPUT PARAMETERS:
C     MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C     PHSTR  - INTEGER - PHIGS STRUCTURE IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR, MNUATT, MNUAT1, MNUPR1, MNUPR2
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE FILL ATTRIBUTES, PRIMITIVES, ETC. IN A MENU PHIGS STRUCTURE
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/04/89 (10:49:13)
C=======================================================================

      SUBROUTINE FAPMST (MENUID, PHSTR)

      INTEGER MENUID, PHSTR

      INTEGER ELEMID

      INTEGER DATLUN
      COMMON /DATSTR/ DATLUN


**************************************************
C START OF COMMON BLOCK FOR SAVING MENU ATTRIBUTES
**************************************************
      INTEGER NATT

      INTEGER MAXN, MAXITM

      PARAMETER (MAXN = 50, MAXITM = 20)

      INTEGER TPATH(MAXN), THAL(MAXN), TVAL(MAXN), TCI(MAXN),
     >        TFONT(MAXN), TIND(MAXN), TPREC(MAXN), TBFLAG(MAXN),
     >        TOFLAG(MAXN), TBCI(MAXN), TOCI(MAXN), TBS(MAXN),
     >        TBSI(MAXN), TOLT(MAXN),

     >        IPATH(MAXN), IHAL(MAXN), IVAL(MAXN), ICI(MAXN),
     >        IFONT(MAXN), IIND(MAXN), IPREC(MAXN), IBFLAG(MAXN),
     >        IOFLAG(MAXN), IBCI(MAXN), IOCI(MAXN), IBS(MAXN),
     >        IBSI(MAXN), IOLT(MAXN),

     >        DLOGID(MAXN), PRMTLN(MAXN)

      REAL THT(MAXN), TSPACE(MAXN), TEXPAN(MAXN), TUPX(MAXN),TUPY(MAXN),
     >     TOW(MAXN), TXLOC(MAXN), TYLOC(MAXN),
     >     IHT(MAXN), ISPACE(MAXN), IEXPAN(MAXN), IUPX(MAXN),IUPY(MAXN),
     >     IOW(MAXN), IXLOC(MAXITM, MAXN), IYLOC(MAXITM, MAXN)

      CHARACTER*80 PROMPT(MAXN)

      COMMON /MNUATT/ NATT,
```

```
     >        TPATH, THAL, TVAL, TCI, TFONT, TIND, TPREC, TBFLAG,
     >        TOFLAG, TBCI, TOCI, TBS, TBSI, TOLT,
     >        IPATH, IHAL, IVAL, ICI, IFONT, IIND, IPREC, IBFLAG,
     >        IOFLAG, IBCI, IOCI, IBS, IBSI, IOLT,
     >        DLOGID, PRMTLN,
     >        THT, TSPACE, TEXPAN, TUPX, TUPY, TOW, TXLOC, TYLOC,
     >        IHT, ISPACE, IEXPAN, IUPX, IUPY, IOW, IXLOC, IYLOC
      COMMON /MNUAT1/ PROMPT
*********************
C END OF COMMON BLOCK
*********************


************************************************************
C START OF COMMON BLOCK FOR SAVING MENU PROMPT PARAMETERS
************************************************************
      INTEGER NMENUS
      PARAMETER (NMENUS=200)

      INTEGER MDGID(NMENUS), MPRMTL(NMENUS)
      CHARACTER*80 MPRMPT(NMENUS)

      COMMON /MNUPR1/ MDGID, MPRMTL
      COMMON /MNUPR2/ MPRMPT

*********************
C END OF COMMON BLOCK
*********************

C     READ THE NEXT ELEMENT IN THE DATA STRUCTURE
50    READ (DATLUN, *) ELEMID

C     CALL THE APPROPRIATE ROUTINE FOR THE STRUCTURE ELEMENT

      IF (ELEMID .EQ. 1001) THEN
C        CALL FILL MENU EXECUTE SUB-STRUCTURE
         CALL FEXMST (MENUID, PHSTR)

         GO TO 50

      ELSEIF (ELEMID .GE. 1010 .AND. ELEMID .LE. 1019) THEN
C        CALL FILL MENU PRIMITIVES
         CALL FPRMST (ELEMID)

         GO TO 50

      ELSEIF (ELEMID .GE. 1020 .AND. ELEMID .LE. 1030) THEN
C        CALL FILL MENU PRIMITIVE LOCATIONS
         CALL FLCMST (ELEMID)

         GO TO 50

      ELSEIF (ELEMID .GE. 1050 .AND. ELEMID .LE. 1099) THEN
C        CALL FILL MENU ATTRIBUTES
         CALL FATMST (MENUID, ELEMID)

         GO TO 50

      ELSEIF (ELEMID .EQ. 2005) THEN
C        CALL FILL MENU LABEL
*        CALL FLBMST

         GO TO 50

      ELSEIF (ELEMID .EQ. 2001) THEN


C        STORE THE MENU DIALOG ID IN THE COMMON BLOCK
         MDGID(MENUID) = DLOGID(1)

C        STORE THE MENU PROMPT IN THE COMMON BLOCK
         MPRMTL(MENUID) = PRMTLN (1)
         MPRMPT(MENUID) = PROMPT (1)

C        RETURN FROM THE DATA STRUCTURE
         RETURN

      ELSE

         GO TO 50

      ENDIF

      END
```

```
C=====================================================================
C                        M O D U L E   F E X M S T
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:   FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL FEXMST (MENUID, PHSTR)
C=====================================================================
C INPUT PARAMETERS:
C     MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C     PHSTR  - INTEGER - PHIGS STRUCTURE IDENTIFIER
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR, MNUATT, MNUAT1, NXSTR, EXMNST
C=====================================================================
C COMMON OUTPUTS:
C     MNUATT, MNUAT1, NXSTR, EXMNST
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE FILL EXECUTE MENU SUB STRUCUTRE
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/05/89 (12:14:33)
C=====================================================================

      SUBROUTINE FEXMST (MENUID, PHSTR)

      INTEGER PHSTR, MENUID

      INTEGER NEWMNU

      INTEGER NXTSTR
      COMMON /PHGSTR/ NXTSTR

      INTEGER DATLUN
      COMMON /DATSTR/ DATLUN

      INTEGER NST, MNPHST(100), MNST(100)
      COMMON /EXMNST/ NST, MNPHST, MNST

**************************************************
C START OF COMMON BLOCK FOR SAVING MENU ATTRIBUTES
**************************************************
      INTEGER NATT

      INTEGER MAXN, MAXITM

      PARAMETER (MAXN = 50, MAXITM = 20)

      INTEGER TPATH(MAXN), THAL(MAXN), TVAL(MAXN), TCI(MAXN),
     >        TFONT(MAXN), TIND(MAXN), TPREC(MAXN), TBFLAG(MAXN),
     >        TOFLAG(MAXN), TBCI(MAXN), TOCI(MAXN), TBS(MAXN),
     >        TBSI(MAXN), TOLT(MAXN),

     >        IPATH(MAXN), IHAL(MAXN), IVAL(MAXN), ICI(MAXN),
     >        IFONT(MAXN), IIND(MAXN), IPREC(MAXN), IBFLAG(MAXN),
     >        IOFLAG(MAXN), IBCI(MAXN), IOCI(MAXN), IBS(MAXN),
     >        IBSI(MAXN), IOLT(MAXN),

     >        DLOGID(MAXN), PRMTLN(MAXN)

      REAL THT(MAXN), TSPACE(MAXN), TEXPAN(MAXN), TUPX(MAXN),TUPY(MAXN),
     >     TOW(MAXN), TXLOC(MAXN), TYLOC(MAXN),
     >     IHT(MAXN), ISPACE(MAXN), IEXPAN(MAXN), IUPX(MAXN),IUPY(MAXN),
     >     IOW(MAXN), IXLOC(MAXITM, MAXN), IYLOC(MAXITM, MAXN)

      CHARACTER*80 PROMPT(MAXN)

      COMMON /MNUATT/ NATT,
```

```
     >        TPATH, THAL, TVAL, TCI, TFONT, TIND, TPREC, TBFLAG,
     >        TOFLAG, TBCI, TOCI, TBS, TBSI, TOLT,
     >        IPATH, IHAL, IVAL, ICI, IFONT, IIND, IPREC, IBFLAG,
     >        IOFLAG, IBCI, IOCI, IBS, IBSI, IOLT,
     >        DLOGID, PRMTLN,
     >        THT, TSPACE, TEXPAN, TUPX, TUPY, TOW, TXLOC, TYLOC,
     >        IHT, ISPACE, IEXPAN, IUPX, IUPY, IOW, IXLOC, IYLOC
      COMMON /MNUAT1/ PROMPT
**********************
C END OF COMMON BLOCK
**********************

C     INCREMENT THE NUMBER OF WAITING ATTRIBUTE LISTS
      NATT = NATT + 1

C     SAVE THE ATTRIBUTES

         TPATH (NATT)  = TPATH (NATT-1)
         THAL (NATT)   = THAL (NATT-1)
         TVAL (NATT)   = TVAL (NATT-1)
         TCI (NATT)    = TCI (NATT-1)
         TFONT (NATT)  = TFONT (NATT-1)
         TIND (NATT)   = TIND (NATT-1)
         TPREC (NATT)  = TPREC (NATT-1)
         TBFLAG (NATT) = TBFLAG (NATT-1)
         TOFLAG (NATT) = TOFLAG (NATT-1)
         TBCI (NATT)   = TBCI (NATT-1)
         TOCI (NATT)   = TOCI (NATT-1)
         TBS (NATT)    = TBS (NATT-1)
         TBSI (NATT)   = TBSI (NATT-1)
         TOLT (NATT)   = TOLT (NATT-1)

         IPATH (NATT)  = IPATH (NATT-1)
         IHAL (NATT)   = IHAL (NATT-1)
         IVAL (NATT)   = IVAL (NATT-1)
         ICI (NATT)    = ICI (NATT-1)
         IFONT (NATT)  = IFONT (NATT-1)
         IIND (NATT)   = IIND (NATT-1)
         IPREC (NATT)  = IPREC (NATT-1)
         IBFLAG (NATT) = IBFLAG (NATT-1)
         IOFLAG (NATT) = IOFLAG (NATT-1)
         IBCI (NATT)   = IBCI (NATT-1)
         IOCI (NATT)   = IOCI (NATT-1)
         IBS (NATT)    = IBS (NATT-1)
         IBSI (NATT)   = IBSI (NATT-1)
         IOLT (NATT)   = IOLT (NATT-1)

         DLOGID (NATT) = DLOGID (NATT-1)
         PRMTLN (NATT) = PRMTLN (NATT-1)

         THT (NATT)    = THT (NATT-1)
         TSPACE (NATT) = TSPACE (NATT-1)
         TEXPAN (NATT) = TEXPAN (NATT-1)
         TUPX (NATT)   = TUPX (NATT-1)
         TUPY (NATT)   = TUPY (NATT-1)
         TOW (NATT)    = TOW (NATT-1)
         TXLOC (NATT)  = TXLOC (NATT-1)
         TYLOC (NATT)  = TYLOC (NATT-1)
         IHT (NATT)    = IHT (NATT-1)
         ISPACE (NATT) = ISPACE (NATT-1)
         IEXPAN (NATT) = IEXPAN (NATT-1)
         IUPX (NATT)   = IUPX (NATT-1)
         IUPY (NATT)   = IUPY (NATT-1)
         IOW (NATT)    = IOW (NATT-1)

         PROMPT (NATT) = PROMPT (NATT-1)

         DO 50 ITEM = 1, MAXITM

              IXLOC(ITEM, NATT) = IXLOC(ITEM, NATT-1)
              IYLOC(ITEM, NATT) = IYLOC(ITEM, NATT-1)

50       CONTINUE

100   CONTINUE


C     GET THE SUB MENU IDENTIFIER FROM THE MENU DATA STRUCTURE
      READ (DATLUN, *) NEWMNU

C     CALCULATE THE NEW PHIGS STRUCTURE
      NXTSTR = NXTSTR + 1

C     SET THE PICK IDENTIFIER FOR THE MENU SUB STRUCTURE
```

```
      CALL PSHPID (NEWMNU)

C     EXECUTE THE MENU SUB STRUCTURE
      CALL PEXST (NXTSTR)

C     ADD THE NEW STRUCTURE TO THE LIST OF MENU STRUCTURES WAITING TO
C     BE EXECUTED
      NST = NST + 1
      MNPHST(NST) = NXTSTR
      MNST(NST) = NEWMNU

      RETURN
      END

C=======================================================================
C                        M O D U L E   F P R M S T
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL FPRMST (ELEMID)
C=======================================================================
C INPUT PARAMETERS:
C     ELEMID - INTEGER - ELEMENT IDENTIFIER FOR STRUCTURE ELEMENT
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR, MNUATT, MNUAT1
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE FILL PRIMITIVES IN PHIGS MENU STRUCTURE
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/05/89 (15:20:55)
C=======================================================================

      SUBROUTINE FPRMST (ELEMID)

      INTEGER ELEMID

      INTEGER INT1, NPTBFA
      REAL XBFA(20), YBFA(20)
      CHARACTER TITLE*20, ITEM1*20

      INTEGER NITEMS, ILENGT(10), NPBFA(10), MENUID(10)

      REAL IXBFA(50), IYBFA(50)

      CHARACTER  ITEMS(10)*20

      REAL XFA(20), YFA(20)

      INTEGER DATLUN
      COMMON /DATSTR/ DATLUN

**************************************************
C START OF COMMON BLOCK FOR SAVING MENU ATTRIBUTES
**************************************************
      INTEGER NATT

      INTEGER MAXN, MAXITM

      PARAMETER (MAXN = 50, MAXITM = 20)

      INTEGER TPATH(MAXN), THAL(MAXN), TVAL(MAXN), TCI(MAXN),
     >        TFONT(MAXN), TIND(MAXN), TPREC(MAXN), TBFLAG(MAXN),
     >        TOFLAG(MAXN), TBCI(MAXN), TOCI(MAXN), TBS(MAXN),
     >        TBSI(MAXN), TOLT(MAXN),
```

```
     >        IPATH(MAXN), IHAL(MAXN), IVAL(MAXN), ICI(MAXN),
     >        IFONT(MAXN), IIND(MAXN), IPREC(MAXN), IBFLAG(MAXN),
     >        IOFLAG(MAXN), IBCI(MAXN), IOCI(MAXN), IBS(MAXN),
     >        IBSI(MAXN), IOLT(MAXN),

     >        DLOGID(MAXN), PRMTLN(MAXN)

      REAL THT(MAXN), TSPACE(MAXN), TEXPAN(MAXN), TUPX(MAXN),TUPY(MAXN),
     >     TOW(MAXN), TXLOC(MAXN), TYLOC(MAXN),
     >     IHT(MAXN), ISPACE(MAXN), IEXPAN(MAXN), IUPX(MAXN),IUPY(MAXN),
     >     IOW(MAXN), IXLOC(MAXITM, MAXN), IYLOC(MAXITM, MAXN)

      CHARACTER*80 PROMPT(MAXN)

      COMMON /MNUATT/ NATT,
     >        TPATH, THAL, TVAL, TCI, TFONT, TIND, TPREC, TBFLAG,
     >        TOFLAG, TBCI, TOCI, TBS, TBSI, TOLT,
     >        IPATH, IHAL, IVAL, ICI, IFONT, IIND, IPREC, IBFLAG,
     >        IOFLAG, IBCI, IOCI, IBS, IBSI, IOLT,
     >        DLOGID, PRMTLN,
     >        THT, TSPACE, TEXPAN, TUPX, TUPY, TOW, TXLOC, TYLOC,
     >        IHT, ISPACE, IEXPAN, IUPX, IUPY, IOW, IXLOC, IYLOC
      COMMON /MNUAT1/ PROMPT
**********************
C END OF COMMON BLOCK
**********************

C PROCESS THE TITLE PRIMITIVE

      IF (ELEMID .EQ. 1010 .OR. ELEMID .EQ. 1012) THEN

C        READ THE INTEGER PARAMETERS
         READ(DATLUN,*) INT1, NPTBFA

C        READ THE FILL AREA COORDINATES
         READ(DATLUN,1001) (XBFA(I), I=1,NPTBFA)
         READ(DATLUN,1001) (YBFA(I), I=1,NPTBFA)


50       CONTINUE

C        SET THE PICK IDENTIFIER
         CALL PSHPID(-1)

C        CHECK THE BACKGROUND FLAG
         IF (TBFLAG(1) .NE. 0 .AND. NPTBFA .GT. 2) THEN

C             DUMP ALL THE FILL AREA ATTRIBUTES

              CALL PSEDFG (TOFLAG(1))
              CALL PSICI  (TBCI(1))
              CALL PSEDCI (TOCI(1))
              CALL PSIS   (TBS(1))
              CALL PSISI  (TBSI(1))
              CALL PSEDT  (TOLT(1))
********** GRAPHIGS CALL
              CALL GPESC  (TOW(1))
**********

C        CALCULATE THE ABSOLUTE COORDINATES OF THE FILL AREA VERTICES

              DO 75 IFA = 1, NPTBFA

                   XBFA (IFA) = XBFA(IFA) + TXLOC(1)
                   YBFA (IFA) = YBFA(IFA) + TYLOC(1)

75            CONTINUE


C             DRAW THE FILL AREA
              CALL PFA (NPTBFA, XBFA, YBFA)

         ENDIF

C        IF IT IS A TITLE TEXT, READ THE TITLE
         IF (ELEMID .EQ. 1010) THEN

              READ (DATLUN, '(A)') TITLE

C             DUMP ALL THE TEXT ATTRIBUTES

              CALL PSTXP  (TPATH(1))
              CALL PSTXAL (THAL(1), TVAL(1))
```

```
                CALL PSTXCI (TCI(1))
                CALL PSTXFN (TFONT(1))
                CALL PSTXI  (TIND(1))
                CALL PSTXPR (TPREC(1))
                CALL PSCHH  (THT(1))
*               CALL PSCHSP (TSPACE(1))
                CALL PSCHXP (TEXPAN(1))
                CALL PSCHUP (TUPX, TUPY(1))

C               DRAW THE TITLE TEXT
                CALL PTXS (TXLOC(1), TYLOC(1), INT1, TITLE)

            ENDIF

        ENDIF

C PROCESS THE ITEMS PRIMITIVE

        IF (ELEMID .EQ. 1014 .OR. ELEMID .EQ. 1016) THEN

C           READ THE INTEGER PARAMETERS
            READ(DATLUN, *) NITEMS

            READ(DATLUN, 1002) (ILENGT(I), I=1,NITEMS)
            READ(DATLUN, 1002) (NPBFA (I), I=1,NITEMS)
            READ(DATLUN, 1002) (MENUID(I), I=1,NITEMS)

C           CALCULATE THE TOTAL NUMBER OF POINTS FOR THE BACKGROUND
            NTOT = 0

            DO 100 I = 1, NITEMS

               NTOT = NTOT + NPBFA(I)

100         CONTINUE
C           READ THE REAL PARAMETERS
            READ(DATLUN, 1001) (IXBFA(I), I=1,NTOT)
            READ(DATLUN, 1001) (IYBFA(I), I=1,NTOT)

C           READ THE CHARACTER PARAMETERS
            DO 200 I = 1, NITEMS

               READ(DATLUN, '(A)') ITEMS(I)

200         CONTINUE

C           CHECK THE BACKGROUND FLAG
            IF (IBFLAG(1) .NE. 0 ) THEN

C               DUMP ALL THE FILL AREA ATTRIBUTES

                CALL PSEDFG (IOFLAG(1))
                CALL PSICI  (IBCI(1))
                CALL PSEDCI (IOCI(1))
                CALL PSIS   (IBS(1))
                CALL PSISI  (IBSI(1))
                CALL PSEDT  (IOLT(1))
********** GRAPHIGS CALL
                CALL GPESC  (ION(1))
**********
            ENDIF

C           IF THE PRIMITIVE IS AN ITEM TEXT, SET THE ITEM TEXT ATTRIBUTES
            IF (ELEMID .EQ. 1014) THEN

C               DUMP ALL THE TEXT ATTRIBUTES

                CALL PSTXP  (IPATH(1))
                CALL PSTXAL (IHAL(1), IVAL(1))
                CALL PSTXCI (ICI(1))
                CALL PSTXFN (IFONT(1))
                CALL PSTXI  (IIND(1))
                CALL PSTXPR (IPREC(1))
                CALL PSCHH  (IHT(1))
*               CALL PSCHSP (ISPACE(1))
                CALL PSCHXP (IEXPAN(1))
                CALL PSCHUP (IUPX, IUPY(1))

            ENDIF

C DRAW EACH MENU ITEM

C           RESET THE NUMBER OF BACKGROUND POINTS USED
            NPOINT = 1
```

```
          DO 300 ITEM = 1, NITEMS
C            SET THE PICK IDENTIFIER
             CALL PSHPID(MENUID(ITEM))
C            DRAW THE FILL AREA
             IF (NPBFA(ITEM) .GT. 0 .AND. IBFLAG(1) .NE. 0) THEN
                    DO 400 IPOINT = 1, NPBFA(ITEM)
C                        CALCULATE THE ABSOLUTE COORDINATES OF THE POINTS
                         XFA(IPOINT) = IXBFA(NPOINT)+IXLOC(ITEM,1)
                         YFA(IPOINT) = IYBFA(NPOINT)+IYLOC(ITEM,1)
C                        INCREMENT THE NUMBER OF POINTS USED
                         NPOINT = NPOINT+1
400                 CONTINUE
C                   DRAW THE FILL AREA
                    CALL PFA (NPBFA(ITEM), XFA, YFA)
             ENDIF
C            IF IT IS AN ITEM TEXT, DRAW THE ITEM
             IF (ELEMID .EQ. 1014) THEN
       ITEM1 = ITEMS(ITEM)
C               DRAW THE ITEM TEXT
                CALL PTXS (IXLOC(ITEM,1),IYLOC(ITEM,1),
     >          ILENGT(ITEM), ITEMS(ITEM))
             ENDIF
300       CONTINUE
       ENDIF
1001   FORMAT(6E12.5)
1002   FORMAT(6I12)
       RETURN
       END
C=====================================================================
C                        M O D U L E   F A T M S T
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL FATMST (MENUID, ELEMID)
C=====================================================================
C INPUT PARAMETERS:
C     MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C     ELEMID - INTEGER - ELEMENT IDENTIFIER FOR STRUCTURE ELEMENT
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     MNUATT, MNUAT1
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE FILL MENU ATTRIBUTES IN ATTRIBUTE COMMON BLOCK
C=====================================================================
C MODULES CALLED:
```

```
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/18/89 (08:58:55)
C=====================================================================

      SUBROUTINE FATMST (MENUID, ELEMID)

      INTEGER MENUID, ELEMID

      INTEGER DATLUN
      COMMON /DATSTR/ DATLUN

**************************************************
C START OF COMMON BLOCK FOR SAVING MENU ATTRIBUTES
**************************************************
      INTEGER NATT

      INTEGER MAXN, MAXITM

      PARAMETER (MAXN = 50, MAXITM = 20)

      INTEGER TPATH(MAXN), THAL(MAXN), TVAL(MAXN), TCI(MAXN),
     >        TFONT(MAXN), TIND(MAXN), TPREC(MAXN), TBFLAG(MAXN),
     >        TOFLAG(MAXN), TBCI(MAXN), TOCI(MAXN), TBS(MAXN),
     >        TBSI(MAXN), TOLT(MAXN),

     >        IPATH(MAXN), IHAL(MAXN), IVAL(MAXN), ICI(MAXN),
     >        IFONT(MAXN), IIND(MAXN), IPREC(MAXN), IBFLAG(MAXN),
     >        IOFLAG(MAXN), IBCI(MAXN), IOCI(MAXN), IBS(MAXN),
     >        IBSI(MAXN), IOLT(MAXN),

     >        DLOGID(MAXN), PRMTLN(MAXN)

      REAL THT(MAXN), TSPACE(MAXN), TEXPAN(MAXN), TUPX(MAXN),TUPY(MAXN),
     >     TOW(MAXN), TXLOC(MAXN), TYLOC(MAXN),
     >     IHT(MAXN), ISPACE(MAXN), IEXPAN(MAXN), IUPX(MAXN),IUPY(MAXN),
     >     IOW(MAXN), IXLOC(MAXITM, MAXN), IYLOC(MAXITM, MAXN)

      CHARACTER*80 PROMPT(MAXN)

      COMMON /MNUATT/ NATT,
     >        TPATH, THAL, TVAL, TCI, TFONT, TIND, TPREC, TBFLAG,
     >        TOFLAG, TBCI, TOCI, TBS, TBSI, TOLT,
     >        IPATH, IHAL, IVAL, ICI, IFONT, IIND, IPREC, IBFLAG,
     >        IOFLAG, IBCI, IOCI, IBS, IBSI, IOLT,
     >        DLOGID, PRMTLN,
     >        THT, TSPACE, TEXPAN, TUPX, TUPY, TOW, TXLOC, TYLOC,
     >        IHT, ISPACE, IEXPAN, IUPX, IUPY, IOW, IXLOC, IYLOC
      COMMON /MNUAT1/ PROMPT
**********************
C END OF COMMON BLOCK
**********************

C     PROCESS THE MENU TITLE ATTRIBUTE

      IF (ELEMID .EQ. 1050) THEN

         READ (DATLUN,*) TPATH (1)

      ELSEIF (ELEMID .EQ. 1051) THEN

         READ (DATLUN,*) THT (1)

      ELSEIF (ELEMID .EQ. 1052) THEN

         READ (DATLUN,*) TSPACE (1)

      ELSEIF (ELEMID .EQ. 1053) THEN

         READ (DATLUN,*) TEXPAN (1)

      ELSEIF (ELEMID .EQ. 1054) THEN

         READ (DATLUN,*) THAL (1), TVAL (1)

      ELSEIF (ELEMID .EQ. 1055) THEN

         READ (DATLUN,*) TCI (1)

      ELSEIF (ELEMID .EQ. 1056) THEN

         CALL ERRMSG ('FATMST', 'CHARACTER SET NOT SUPPORTED')
```

```
            READ (DATLUN,*) JUNK
         ELSEIF (ELEMID .EQ. 1057) THEN
            READ (DATLUN,*) TFONT (1)
         ELSEIF (ELEMID .EQ. 1058) THEN
            READ (DATLUN,*) TIND (1)
         ELSEIF (ELEMID .EQ. 1059) THEN
            READ (DATLUN,*) TPREC (1)
         ELSEIF (ELEMID .EQ. 1060) THEN
            READ (DATLUN,*) TUPX (1), TUPY(1)
         ELSEIF (ELEMID .EQ. 1061) THEN
            READ (DATLUN,*) TBFLAG (1)
         ELSEIF (ELEMID .EQ. 1062) THEN
            READ (DATLUN,*) TOFLAG (1)
         ELSEIF (ELEMID .EQ. 1063) THEN
            READ (DATLUN,*) TBCI (1)
         ELSEIF (ELEMID .EQ. 1064) THEN
            READ (DATLUN,*) TOCI (1)
         ELSEIF (ELEMID .EQ. 1065) THEN
            READ (DATLUN,*) TBS (1)
         ELSEIF (ELEMID .EQ. 1066) THEN
            READ (DATLUN,*) TBSI (1)
         ELSEIF (ELEMID .EQ. 1067) THEN
            READ (DATLUN,*) TOLT (1)
         ELSEIF (ELEMID .EQ. 1068) THEN
            READ (DATLUN,*) TOW (1)
C** UNDEFINED ELEMENT ID**********
C*       ELSEIF (ELEMID .EQ. 1069) THEN
C*
C*          READ (DATLUN,*)
C************************************

C        PROCESS THE MENU ITEM ATTRIBUTE
         ELSEIF (ELEMID .EQ. 1070) THEN
            READ (DATLUN,*) IPATH (1)
         ELSEIF (ELEMID .EQ. 1071) THEN
            READ (DATLUN,*) IHT (1)
         ELSEIF (ELEMID .EQ. 1072) THEN
            READ (DATLUN,*) ISPACE (1)
         ELSEIF (ELEMID .EQ. 1073) THEN
            READ (DATLUN,*) IEXPAN (1)
         ELSEIF (ELEMID .EQ. 1074) THEN
            READ (DATLUN,*) IHAL (1), IVAL (1)
         ELSEIF (ELEMID .EQ. 1075) THEN
            READ (DATLUN,*) ICI (1)
         ELSEIF (ELEMID .EQ. 1076) THEN
```

```
            CALL ERRMSG ('FATMST', 'CHARACTER SET NOT SUPPORTED')
            READ (DATLUN,*) JUNK

         ELSEIF (ELEMID .EQ. 1077) THEN

            READ (DATLUN,*) IFONT (1)

         ELSEIF (ELEMID .EQ. 1078) THEN

            READ (DATLUN,*) IIND (1)

         ELSEIF (ELEMID .EQ. 1079) THEN

            READ (DATLUN,*) IPREC (1)

         ELSEIF (ELEMID .EQ. 1080) THEN

            READ (DATLUN,*) IUPX (1), IUPY(1)

         ELSEIF (ELEMID .EQ. 1081) THEN

            READ (DATLUN,*) IBFLAG (1)

         ELSEIF (ELEMID .EQ. 1082) THEN

            READ (DATLUN,*) IOFLAG (1)

         ELSEIF (ELEMID .EQ. 1083) THEN

            READ (DATLUN,*) IBCI (1)

         ELSEIF (ELEMID .EQ. 1084) THEN

            READ (DATLUN,*) IOCI (1)

         ELSEIF (ELEMID .EQ. 1085) THEN

            READ (DATLUN,*) IBS (1)

         ELSEIF (ELEMID .EQ. 1086) THEN

            READ (DATLUN,*) IBSI (1)

         ELSEIF (ELEMID .EQ. 1087) THEN

            READ (DATLUN,*) IOLT (1)

         ELSEIF (ELEMID .EQ. 1088) THEN

            READ (DATLUN,*) IOM (1)

   ** UNDEFINED ELEMENT ID**************
   *     ELSEIF (ELEMID .EQ. 1089) THEN
   *
   *        READ (DATLUN,*)
   ************************************

   C     PROCESS THE DIALOG ATTRIBUTES

         ELSEIF (ELEMID .EQ. 1091) THEN

            READ (DATLUN,*) DLOGID (1)

         ELSEIF (ELEMID .EQ. 1092) THEN

            READ (DATLUN,*) PRMTLN (1)
            READ (DATLUN,'(A)') PROMPT (1)

         ENDIF


         RETURN
         END

   C=====================================================================
   C                        M O D U L E   F L C M S T
   C=====================================================================
   C  PROJECT:  CADMADE
   C  VERSION:  X1.0.0
   C   PART   :  UIE-___
   C MODULE   :  _
   C=====================================================================
   C COMPILER:  FORTVS2 (FORTRAN 77)
```

```
C=====================================================================
C CALLING SEQUENCE:
C     CALL FLCMST (ELEMID)
C=====================================================================
C INPUT PARAMETERS:
C     ELEMID - INTEGER - ELEMENT IDENTIFIER FOR STRUCTURE ELEMENT
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     MNUATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE FILL MENU LOCATIONS IN ATTRIBUTE COMMON BLOCK
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/18/89 (08:58:55)
C=====================================================================

      SUBROUTINE FLCMST (ELEMID)

      INTEGER ELEMID

      INTEGER DATLUN
      COMMON /DATSTR/ DATLUN

**************************************************
C START OF COMMON BLOCK FOR SAVING MENU ATTRIBUTES
**************************************************
      INTEGER NATT

      INTEGER MAXN, MAXITM

      PARAMETER (MAXN = 50, MAXITM = 20)

      INTEGER TPATH(MAXN), THAL(MAXN), TVAL(MAXN), TCI(MAXN),
     >        TFONT(MAXN), TIND(MAXN), TPREC(MAXN), TBFLAG(MAXN),
     >        TOFLAG(MAXN), TBCI(MAXN), TOCI(MAXN), TBS(MAXN),
     >        TBSI(MAXN), TOLT(MAXN),

     >        IPATH(MAXN), IHAL(MAXN), IVAL(MAXN), ICI(MAXN),
     >        IFONT(MAXN), IIND(MAXN), IPREC(MAXN), IBFLAG(MAXN),
     >        IOFLAG(MAXN), IBCI(MAXN), IOCI(MAXN), IBS(MAXN),
     >        IBSI(MAXN), IOLT(MAXN),

     >        DLOGID(MAXN), PRMTLN(MAXN)

      REAL THT(MAXN), TSPACE(MAXN), TEXPAN(MAXN), TUPX(MAXN),TUPY(MAXN),
     >     TOW(MAXN), TXLOC(MAXN), TYLOC(MAXN),
     >     IHT(MAXN), ISPACE(MAXN), IEXPAN(MAXN), IUPX(MAXN),IUPY(MAXN),
     >     IOW(MAXN), IXLOC(MAXITM, MAXN), IYLOC(MAXITM, MAXN)

      CHARACTER*80 PROMPT(MAXN)

      COMMON /MNUATT/ NATT,
     >        TPATH, THAL, TVAL, TCI, TFONT, TIND, TPREC, TBFLAG,
     >        TOFLAG, TBCI, TOCI, TBS, TBSI, TOLT,
     >        IPATH, IHAL, IVAL, ICI, IFONT, IIND, IPREC, IBFLAG,
     >        IOFLAG, IBCI, IOCI, IBS, IBSI, IOLT,
     >        DLOGID, PRMTLN,
     >        THT, TSPACE, TEXPAN, TUPX, TUPY, TOW, TXLOC, TYLOC,
     >        IHT, ISPACE, IEXPAN, IUPX, IUPY, IOW, IXLOC, IYLOC
      COMMON /MNUAT1/ PROMPT
**********************
C END OF COMMON BLOCK
**********************

C     PROCESS THE MENU TITLE LOCATION

      IF (ELEMID .EQ. 1020) THEN

         READ (DATLUN,*) TXLOC (1), TYLOC(1)

      ELSEIF (ELEMID .EQ. 1030) THEN
```

```
         READ (DATLUN,*) NUMBER
         READ (DATLUN,1001) (IXLOC(I,1), I=1,NUMBER)
         READ (DATLUN,1001) (IYLOC(I,1), I=1,NUMBER)

      ENDIF

1001  FORMAT(6E12.5)

      RETURN
      END

C=======================================================================
C                          C A D M A D E   M O D U L E   C M P O M N
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMPOMN (WKID, MENUID, PRIORT)
C=======================================================================
C INPUT PARAMETERS:
C     WKID   - INTEGER - WORKSTATION IDENTIFIER
C     MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C     PRIORT - REAL - STRUCTURE PRIORITY
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     MNPHRT
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE POST MENU ROOT
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/05/89 (18:48:49)
C=======================================================================

      SUBROUTINE CMPOMN (WKID, MENUID, PRIORT)

      INTEGER WKID, MENUID

      REAL PRIORT

      INTEGER PHRT, ROOT

      INTEGER NROOTS

      PARAMETER (NROOTS = 9)

      INTEGER AVALRT (NROOTS,2)

      COMMON /MNPHRT/ AVALRT

C     SET THE ERROR INDICATOR
      IER = 1

C     FIND THE ROOT WHICH HAS THE MENU
      DO 100 IROOT = 1, NROOTS

         IF (AVALRT(IROOT, 2) .EQ. MENUID) THEN

C              RESET THE ERROR INDICATOR
               IER = 0

C              STOP THE SEARCH
               GO TO 200

         ENDIF
```

```
100   CONTINUE

200   IF (IER .EQ. 0) THEN

C        CALCULATE THE STRUCTURE TO BE MODIFIED
         PHRT = 1000*IROOT + 1

C        CALCULATE THE ROOT TO BE POSTED
         ROOT = IROOT*10000

C        POST THE ROOT
         CALL PPORT (WKID, ROOT, PRIORT)

C        DISPLAY THE MENU PROMPT
         CALL DSPRMT (WKID, MENUID)

      ELSE

C        WRITE ERROR MESSAGE
         CALL ERRMSG ('CMPOMN','MENU ROOT HAS NOT BEEN CREATED')

      ENDIF

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M U P M N
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMUPMN (WKID, MENUID)
C=====================================================================
C INPUT PARAMETERS:
C     WKID   - INTEGER - WORKSTATION IDENTIFIER
C     MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     MNPHRT
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE UNPOST MENU ROOT
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/05/89 (18:48:49)
C=====================================================================

      SUBROUTINE CMUPMN (WKID, MENUID)

      INTEGER WKID, MENUID

      INTEGER PHRT, ROOT

      INTEGER NROOTS

      PARAMETER (NROOTS = 9)

      INTEGER AVALRT (NROOTS,2)

      COMMON /MNPHRT/ AVALRT

C     SET THE ERROR INDICATOR
      IER = 1

C     FIND THE ROOT WHICH HAS THE MENU
      DO 100 IROOT = 1, NROOTS
```

```
            IF (AVALRT(IROOT, 2) .EQ. MENUID) THEN

C                RESET THE ERROR INDICATOR
                 IER = 0

C                STOP THE SEARCH
                 GO TO 200

            ENDIF

100      CONTINUE

200      IF (IER .EQ. 0) THEN

C           CALCULATE THE STRUCTURE TO BE MODIFIED
            PHRT = 1000*IROOT + 1

C           CALCULATE THE ROOT TO BE POSTED
            ROOT = IROOT*10000

C           OPEN THE STRUCTURE
            CALL POPST (PHRT)

C           SET THE ELEMENT POINTER
            CALL PSEP (4)

C           DELETE THE ELEMENT
            CALL PDEL

C           CHANGE THE NAME TO 126
            CALL PADS (1,126)

C           CLOSE THE STRUCTURE
            CALL PCLST

C           UNPOST THE ROOT
            CALL PUPORT (WKID, ROOT)

         ELSE

C           WRITE ERROR MESSAGE
            CALL ERRMSG ('CMUPMN','MENU ROOT HAS NOT BEEN CREATED')

         ENDIF

         RETURN
         END


C=======================================================================
C                        M O D U L E   G T M N I D
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL GTMNID (PHSTR, MENUID)
C=======================================================================
C INPUT PARAMETERS:
C     PHSTR  - INTEGER - PHIGS STRUCTURE IDENTIFIER
C     MENUID - INTEGER - MENU STRUCTURE IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE GET MENU ID FROM PHIGS STRUCTURE
C=======================================================================
C MODULES CALLED:
C
```

```
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/06/89 (09:51:11)
C=====================================================================

      SUBROUTINE GTMNID (PHSTR, MENUID)

      INTEGER PHSTR, MENUID

      INTEGER TYPE, SIZE, APPDAT

      INTEGER LDR

      PARAMETER (LDR=5, APPDAT=5378)

      INTEGER DATARC(LDR)

C     OPEN THE STRUCTURE
      CALL POPST (PHSTR)

C     SET THE ELEMENT POINTER AT THE CORRECT LOCATION
      CALL PSEP (2)

C     GET THE ELEMENT SIZE AND TYPE
      CALL PQEL (IER, TYPE, SIZE)

      IF (TYPE .EQ. APPDAT) THEN

C        RETRIEVE THE DATA
********** GRAPHIGS CALL
         CALL GPQE (1, SIZE, IER, MLDR, DATARC)

         MENUID = DATARC(5)

      ELSE

C        WRITE ERROR MESSAGE
         CALL ERRMSG ('GTMNID','ERROR IN MENU PHIGS STRUCTURE')

         MENUID = 0

      ENDIF

C     CLOSE THE STRUCTURE
      CALL PCLST

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M N X M N
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMNXMN (WKID, PPD, PP)
C=====================================================================
C INPUT PARAMETERS:
C     WKID - INTEGER - WORKSTATION IDENTIFIER
C     PPD  - INTEGER - PICK PATH DEPTH
C     PP(3,*)-INTEGER- PICK PATH
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE NEXT MENU
C=====================================================================
C MODULES CALLED:
C
```

```
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/06/89 (23:10:00)
C=====================================================================

      SUBROUTINE CMNXMN (WKID, PPD, PP)

      INTEGER WKID, PPD, PP(3,*)

      INTEGER IER

      INTEGER ERROR, NSTR, STRLST(20)

      INTEGER NEWMNU


C     SET THE CURRENT MENU INVISIBLE
      CALL STMNVS (PP(1,PPD),0)

C     SET THE ERROR INDICATOR
      IER = 1

C     IF THE MENU PICKED IS 0, DISPLAY THE ROOT MENU OF THE TREE
      IF (PP(2,PPD) .EQ. 0) THEN

C        SET THE ROOT VISIBLE
         CALL STMNVS (PP(1,2),1)

C        RESET THE ERROR INDICATOR
         IER = 0

C        SET THE MENU ID FOR THE MENU PROMPT
         NEWMNU = PP(2,1)

      ENDIF

C     IF THE MENU PICKED IS -1, DISPLAY THE PARENT OF THE CURRENT MENU
      IF (PP(2,PPD) .EQ. -1 .AND. PP(1,PPD-1) .LT. 10000) THEN

C        SET THE PARENT VISIBLE
         CALL STMNVS (PP(1,PPD-1), 1)

C        RESET THE ERROR INDICATOR
         IER = 0

C        SET THE MENU ID FOR THE MENU PROMPT
         NEWMNU = PP(2,PPD-2)

      ENDIF

C     IF THE MENU PICKED IS > 0, DISPLAY THE NEXT MENU
      IF (PP(2,PPD) .GT. 0) THEN

C        FIND THE EXECUTED STRUCTURES IN THE PHIGS STRUCTURE
********* GRAPHIGS CALL
         CALL GPQEXS (PP(1,PPD), 1, 20, ERROR, NSTR, STRLST)

C        LOOP THROUGH THE EXECUTED STRUCTURES AND FIND THE ONE WHICH
C        HAS THE MENU ID = THE PICKED MENU ID
         DO 100 ISTR = 1, NSTR

C             GET THE MENU ID
              CALL GTMNID (STRLST(ISTR), MENU)


C             CHECK THE MENUID IN THE PHIGS SUB STRUCTURE
              IF (MENU .EQ. PP(2,PPD)) THEN

C                MAKE THE MENU VISIBLE
                 CALL STMNVS (STRLST(ISTR), 1)

C                RESET THE ERROR INDICATOR
                 IER = 0

C                SET THE MENU ID FOR THE MENU PROMPT
                 NEWMNU = PP(2,PPD)

C                STOP THE SEARCH
                 GO TO 200

              ENDIF

100      CONTINUE
```

```
      ENDIF

200   IF (IER .NE. 0) THEN

C        SET THE CURRENT MENU VISIBLE
         CALL STMNVS (PP(1,PPD),1)

      ENDIF


      IF (IER .EQ. 0) THEN

C        DISPLAY THE MENU PROMPT
         CALL DSPRMT (WKID, NEWMNU)

      ENDIF

      RETURN
      END

C=====================================================================
C                      M O D U L E   S T M N V S
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL STMNVS (PHSTR, VIS)
C=====================================================================
C INPUT PARAMETERS:
C     PHSTR - INTEGER - PHIGS STRUCTURE IDENTIFIER
C     VIS   - INTEGER - VISIBILITY FLAG
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET MENU PHIGS STRUCTURE INVISIBLE
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/06/89 (23:12:44)
C=====================================================================

      SUBROUTINE STMNVS (PHSTR, VIS)

      INTEGER PHSTR, VIS

C     OPEN THE STRUCTURE
      CALL POPST (PHSTR)

C     SET THE ELEMENT POINTER
      CALL PSEP (4)

C     DELETE THE ELEMENT
      CALL PDEL

C     CHANGE THE NAME TO 126 FOR INVISIBLE AND 127 FOR VISIBLE
      IVIS = 126 + VIS
      CALL PADS (1,IVIS)

C     CLOSE THE STRUCTURE
      CALL PCLST

      RETURN
      END

C=====================================================================
C                      M O D U L E   D S P R M T
```

```
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL DSPRMT (WKID, MENUID)
C=====================================================================
C INPUT PARAMETERS:
C    WKID - INTEGER - WORKSTATION IDENTIFIER
C     MENUID - INTEGER MENU STRUCTURE IDENTIFIER
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     MNUPR1, MNUPR2
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE DISPLAY MENU PROMPT
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/19/89 (11:54:03)
C=====================================================================

      SUBROUTINE DSPRMT (WKID, MENUID)

      INTEGER WKID, MENUID

**********************************************************
C START OF COMMON BLOCK FOR SAVING MENU PROMPT PARAMETERS
**********************************************************
      INTEGER NMENUS
      PARAMETER (NMENUS=200)

      INTEGER MDGID(NMENUS), MPRMTL(NMENUS)
      CHARACTER*80 MPRMPT(NMENUS)

      COMMON /MNUPR1/ MDGID, MPRMTL
      COMMON /MNUPR2/ MPRMPT

**********************
C END OF COMMON BLOCK
**********************


C     DISPLAY THE MENU PROMPT
      CALL CMMSG (WKID, MDGID(MENUID), MPRMPT(MENUID))

      RETURN
      END




C=====================================================================
C                          C A D M A D E  M O D U L E  C M O M S T
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMOMST (MSTRID)
C=====================================================================
C INPUT PARAMETERS:
C     MSTRID - INTEGER - MENU STRUCTURE IDENTIFIER
```

```
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     2000 - CADMADE OPEN MENU STRUCTURE
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (11:45:33)
C=====================================================================

      SUBROUTINE CMOMST (MSTRID)

      INTEGER MSTRID

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 2000)

C     OPEN NEW MENU STRUCTURE
      WRITE(DATLUN, 1001) 'S  - OPEN MENU STRUCTURE'

C     WRITE THE STRUCTURE IDENTIFIER INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) MSTRID


1001  FORMAT (A24)

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M C M S T
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMCMST
C=====================================================================
C INPUT PARAMETERS:
C
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     2001 - CADMADE CLOSE MENU STRUCTURE
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (11:46:21)
C=====================================================================

      SUBROUTINE CMCMST

      INTEGER ELEMID, DATLUN
```

```
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 2001)

      WRITE(DATLUN, 1003) ELEMID, ' - CLOSE MENU STRUCTIRE'

1003  FORMAT (I4)

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M M S L B
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMSLB (LABEL)
C=====================================================================
C INPUT PARAMETERS:
C     LABEL - INTEGER - LABEL
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     DATSTR
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     2005 - CADMADE SET MENU STRUCTURE LABEL
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (11:47:22)
C=====================================================================

      SUBROUTINE CMMSLB (LABEL)

      INTEGER LABEL

      INTEGER ELEMID, DATLUN
      COMMON /DATSTR/ DATLUN
      PARAMETER (ELEMID = 2005)

      WRITE(DATLUN, *) ELEMID

C     WRITE THE LABEL IDENTIFIER INTO THE DATA STRUCTURE
      WRITE(DATLUN, *) LABEL



      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M M S E P
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMSEP (EP)
C=====================================================================
C INPUT PARAMETERS:
C     EP - INTEGER - ELEMENT NUMBER FOR THE POINTER
C=====================================================================
C OUTPUT PARAMETERS:
```

```
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     2010 - CADMADE SET ELEMENT POINTER IN MENU STRUCTURE
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (11:47:59)
C=======================================================================

      SUBROUTINE CMMSEP (EP)
******THIS SUBROUTINE IS NOT SUPPORTED YET



      RETURN
      END

C=======================================================================
C                          C A D M A D E  M O D U L E  C M M O E P
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMOEP (OFFSET)
C=======================================================================
C INPUT PARAMETERS:
C     OFFSET - INTEGER - OFFSET
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     2015 - CADMADE OFFSET ELEMENT POINTER IN MENU STRUCTURE
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (11:48:55)
C=======================================================================

      SUBROUTINE CMMOEP (OFFSET)
******THIS SUBROUTINE IS NOT SUPPORTED YET



      RETURN
      END

C=======================================================================
C                          C A D M A D E  M O D U L E  C M M E P L
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
```

```
C MODULE  :
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMEPL (LABEL)
C=======================================================================
C INPUT PARAMETERS:
C     LABEL - INTEGER - LABEL
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     2020 - CADMADE SET ELEMENT POINTER AT LABEL IN MENU STRUCTURE
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (11:49:26)
C=======================================================================

      SUBROUTINE CMMEPL (LABEL)
******THIS SUBROUTINE IS NOT SUPPORTED YET



      RETURN
      END

C=======================================================================
C                          C A D M A D E   M O D U L E   C M M D E L
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMMDEL
C=======================================================================
C INPUT PARAMETERS:
C
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     2025 - CADMADE DELETE MENU STRUCTURE ELEMENT
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (11:52:42)
C=======================================================================

      SUBROUTINE CMMDEL
******THIS SUBROUTINE IS NOT SUPPORTED YET
```

```
      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M M D E R
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMDER (EP1, EP2)
C=====================================================================
C INPUT PARAMETERS:
C     EP1 - INTEGER - START ELEMENT
C     EP2 - INTEGER - END ELEMENT
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     2030 - CADMADE DELETE MENU STRUCTURE ELEMENTS BETWEEN RANGE
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (11:53:19)
C=====================================================================

      SUBROUTINE CMMDER (EP1, EP2)
******THIS SUBROUTINE IS NOT SUPPORTED YET



      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M M D L L
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMMDLL (LABEL1, LABEL2)
C=====================================================================
C INPUT PARAMETERS:
C     LABEL1 - INTEGER - START LABEL
C     LABEL2 - INTEGER - END LABEL
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
```

```
C FUNCTIONAL DESCRIPTION:
C     2035 - CADMADE DELETE MENU STRUCTURE ELEMENTS BETWEEN LABELS
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/19/89 (11:53:42)
C=======================================================================

      SUBROUTINE CMMDLL (LABEL1, LABEL2)
******THIS SUBROUTINE IS NOT SUPPORTED YET



      RETURN
      END

C=======================================================================
C                        M O D U L E   F N D L S T
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL FNDLST
C=======================================================================
C INPUT PARAMETERS:
C
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     DATSTR
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADAMADE - FIND THE LAST ELEMENT IN THE STRUCTURE AND MOVE THE
C ELEMENT POINTER TO IT
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/18/89 (13:57:41)
C=======================================================================

      SUBROUTINE FNDLST

      INTEGER DATLUN
      COMMON /DATSTR/ DATLUN

      CHARACTER*4 INCHAR


      DO 100 ILINE = 1, 1000

C        READ THE NEXT ELEMENT IN THE DATA STRUCTURE
         READ (DATLUN,'(A)') INCHAR

         IF (INCHAR .EQ. '2001') THEN

C           IF IT IS A "CLOSE MENU STRUCTURE"
            BACKSPACE (DATLUN)

C           STOP THE SEARCH
            GO TO 200

         ENDIF

100   CONTINUE
```

```
 200   CONTINUE

       READ (DATLUN,'(A)') INCHAR

       RETURN
       END



C=====================================================================
C                          C A D M A D E   M O D U L E   C M D G C H
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C      CALL CMDGCH (DGID, HEIGHT)
C=====================================================================
C INPUT PARAMETERS:
C      DGID - INTEGER - DIALOG AREA IDENTIFIER
C      HEIGHT - REAL - CHARACTER HEIGHT
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C      NONE
C=====================================================================
C COMMON OUTPUTS:
C      DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C      CADMADE SET DIALOG AREA CHARACTER HEIGHT
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C      DATE:  02/18/89 (20:00:32)
C=====================================================================

       SUBROUTINE CMDGCH (DGID, HEIGHT)

       INTEGER DGID
       REAL HEIGHT

*****************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
*****************************************************
       INTEGER MAXN

       PARAMETER (MAXN = 5)

       INTEGER DCI(MAXN),
      >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
      >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
      >        DBSI(MAXN), DOLT(MAXN),
      >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

       REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
      >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

       COMMON /DLGATT/
      >        DCI, DFONT, DIND, DPREC, DBFLAG,
      >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
      >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
      >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

       DHT(DGID) = HEIGHT

       RETURN
```

```
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M D G C S
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMDGCS (DGID, SPACE)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     SPACE - REAL - CHARACTER SPACING
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA CHARACTER SPACING
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:57:11)
C=====================================================================

      SUBROUTINE CMDGCS (DGID, SPACE)

      INTEGER DGID
      REAL SPACE

**************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
**************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOM(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOM, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DSPACE(DGID) = SPACE


      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M D G X P
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
```

```
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMDGXP (DGID, EXPANS)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     EXPANS - REAL - CHARACTER EXPANSION FACTOR
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA CHARACTER EXPANSION FACTOR
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:56:04)
C=====================================================================

      SUBROUTINE CMDGXP (DGID, EXPANS)

      INTEGER DGID
      REAL EXPANS

**************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
**************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DEXPAN(DGID) = EXPANS

      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M D G C I
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMDGCI (DGID, COLOR)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     COLOR - INTEGER - COLOR INDEX
C=====================================================================
```

```
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     DLGATT
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA TEXT COLOR INDEX
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:54:17)
C=======================================================================

      SUBROUTINE CMDGCI (DGID, COLOR)

      INTEGER DGID, COLOR

**************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
**************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DCI(DGID) = COLOR

      RETURN
      END

C=======================================================================
C                          C A D M A D E   M O D U L E   C M D G F O
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMDGFO (DGID, FONT)
C=======================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     FONT - INTEGER - TEXT FONT
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     DLGATT
C=======================================================================
C LOCAL VARIABLES:
C
```

```
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA TEXT FONT
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:52:22)
C=======================================================================

      SUBROUTINE CMDGFO (DGID, FONT)

      INTEGER DGID, FONT

**************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
**************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DFONT(DGID) = FONT

      RETURN
      END

C=======================================================================
C                        C A D M A D E   M O D U L E   C M D G T I
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMDGTI (DGID, INDEX)
C=======================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     INDEX - INTEGER - ATTRIBUTE INDEX
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     DLGATT
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA TEXT INDEX
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:51:03)
C=======================================================================
```

```
      SUBROUTINE CMDGTI (DGID, INDEX)

      INTEGER DGID, INDEX

***************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
***************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DIND(DGID) = INDEX

      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M D G P R
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C    PART  :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMDGPR (DGID, PREC)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     PREC - INTEGER - TEXT PRECISION
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA TEXT PRECISION
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:49:58)
C=====================================================================

      SUBROUTINE CMDGPR (DGID, PREC)

      INTEGER DGID, PREC

***************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
***************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)
```

```
       INTEGER DCI(MAXN),
      >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
      >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
      >        DBSI(MAXN), DOLT(MAXN),
      >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

       REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
      >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

       COMMON /DLGATT/
      >        DCI, DFONT, DIND, DPREC, DBFLAG,
      >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
      >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
      >        DNBUF, DNL, DNCHAR, DMODE, DVIS
*********************
C END OF COMMON BLOCK
*********************

       DPREC(DGID) = PREC

       RETURN
       END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M D G B F
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMDGBF (DGID, FLAG)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     FLAG - INTEGER - AREA BACKGROUND FLAG
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA AREA BACKGROUND FLAG
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:47:40)
C=====================================================================

       SUBROUTINE CMDGBF (DGID, FLAG)

       INTEGER DGID, FLAG

*************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
*************************************************
       INTEGER MAXN

       PARAMETER (MAXN = 5)

       INTEGER DCI(MAXN),
      >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
      >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
      >        DBSI(MAXN), DOLT(MAXN),
      >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

       REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
      >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

       COMMON /DLGATT/
      >        DCI, DFONT, DIND, DPREC, DBFLAG,
```

```
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DBFLAG(DGID) = FLAG

      RETURN
      END

C=======================================================================
C                          C A D M A D E  M O D U L E  C M D G O F
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMDGOF (DGID, FLAG)
C=======================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     FLAG - INTEGER - AREA OUTLINE FLAG
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     DLGATT
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA AREA OUTLINE FLAG
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:46:27)
C=======================================================================

      SUBROUTINE CMDGOF (DGID, FLAG)

      INTEGER DGID, FLAG

**************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
**************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DOFLAG(DGID) = FLAG

      RETURN
      END
```

```
C=====================================================================
C                          C A D M A D E  M O D U L E  C M D G B C
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMDGBC (DGID, COLOR)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     COLOR - INTEGER - AREA BACKGROUND COLOR INDEX
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA AREA BACKGROUND COLOR INDEX
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:45:30)
C=====================================================================

      SUBROUTINE CMDGBC (DGID, COLOR)

      INTEGER DGID, COLOR

**************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
**************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DBCI(DGID) = COLOR


      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M D G O C
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
```

```
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMDGOC (DGID, COLOR)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     COLOR - INTEGER - AREA OUTLINE COLOR INDEX
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA AREA OUTLINE COLOR INDEX
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (19:42:54)
C=====================================================================

      SUBROUTINE CMDGOC (DGID, COLOR)

      INTEGER DGID, COLOR

*****************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
*****************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
*********************
C END OF COMMON BLOCK
*********************

      DOCI(DGID) = COLOR

      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M D G B S
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C    PART  :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMDGBS (DGID, STYLE)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     STYLE - INTEGER - AREA BACKGROUND INTERIOR STYLE
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
```

```
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA AREA BACKGROUND INTERIOR STYLE
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:59:59)
C=====================================================================

      SUBROUTINE CMDGBS (DGID, STYLE)

      INTEGER DGID, STYLE

**************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
**************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DBS(DGID) = STYLE

      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M D G B I
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMDGBI (DGID, INDEX)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     INDEX - INTEGER - AREA BACKGROUND INTERIOR STYLE INDEX
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA AREA BACKGROUND INTERIOR STYLE INDEX
```

```
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:58:43)
C=====================================================================

      SUBROUTINE CMDGBI (DGID, INDEX)

      INTEGER DGID, INDEX

**************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
**************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********
C END OF COMMON BLOCK
**********

      DBSI(DGID) = INDEX


      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M D G O T
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMDGOT (DGID, TYPE)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     TYPE - INTEGER - AREA OUTLINE LINE TYPE
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA AREA OUTLINE LINE TYPE
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:56:55)
C=====================================================================

      SUBROUTINE CMDGOT (DGID, TYPE)
```

```
      INTEGER DGID, TYPE

***************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
***************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DOLT(DGID) = INDEX


      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M D G O W
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMDGOW (DGID, WIDTH)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     WIDTH - REAL - AREA OUTLINE WIDTH FACTOR
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA AREA OUTLINE WIDTH FACTOR
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:56:08)
C=====================================================================

      SUBROUTINE CMDGOW (DGID, WIDTH)

      INTEGER DGID
      REAL WIDTH

***********************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
***********************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)
```

```
      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DOW(DGID) = WIDTH


      RETURN
      END

C=======================================================================
C                          C A D M A D E  M O D U L E  C M D G B U
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMDGBU (DGID, NBUF)
C=======================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     NBUF - INTEGER - DIALOG AREA BUFFER SIZE
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     DLGATT
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA BUFFER SIZE
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:56:08)
C=======================================================================

      SUBROUTINE CMDGBU (DGID, NBUF)

      INTEGER DGID, NBUF

**************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
**************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
```

```
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
*********************
C END OF COMMON BLOCK
*********************

      DNBUF(DGID) = NBUF


      RETURN
      END

C=======================================================================
C                          C A D M A D E  M O D U L E  C M D G N L
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMDGNL (DGID, NLINE)
C=======================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     NLINE - INTEGER - DIALOG AREA NO. OF DISPLAYED LINES
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     DLGATT
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA NO. OF DISPLAYED LINES
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:56:08)
C=======================================================================

      SUBROUTINE CMDGNL (DGID, NLINE)

      INTEGER DGID, NLINE

*************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
*************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
*********************
C END OF COMMON BLOCK
*********************

      DNL(DGID) = NLINE
```

```
      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M D G N C
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMDGNC (DGID, NCHAR)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     NCHAR - INTEGER - DIALOG AREA NO. OF DISPLAYED CHARACTERS PER LINE
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA NO. OF CHARACTERS PER LINE
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:56:08)
C=====================================================================

      SUBROUTINE CMDGNC (DGID, NCHAR)

      INTEGER DGID, NCHAR

**************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
**************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DON(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DON, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DNCHAR(DGID) = NCHAR


      RETURN
      END

C=====================================================================
C                          C A D M A D E  M O D U L E  C M D G M D
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
```

```
C MODULE  : _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMDGMD (DGID, MODE)
C=======================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     MODE - INTEGER - DIALOG AREA MODE - NO-SCROLL/ SCROLL
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     DLGATT
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA SCROLL MODE
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:56:08)
C=======================================================================

      SUBROUTINE CMDGMD (DGID, MODE)

      INTEGER DGID, MODE

**************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
**************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DON(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DON, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DMODE(DGID) = MODE


      RETURN
      END

C=======================================================================
C                          C A D M A D E   M O D U L E   C M D G V S
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  : _
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMDGVS (DGID, VIS)
C=======================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     VIS - INTEGER - DIALOG AREA VISIBILITY
```

```
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA VISIBILITY
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:56:08)
C=====================================================================

      SUBROUTINE CMDGVS (DGID, VIS)

      INTEGER DGID, VIS

**************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
**************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DVIS(DGID) = VIS


      RETURN
      END

C=====================================================================
C                          C A D M A D E   M O D U L E   C M D G L C
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART  :  UIE-___
C MODULE  :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CMDGLC (DGID, X1, X2, Y1, Y2)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER - DIALOG AREA IDENTIFIER
C     X1, X2, Y1, Y2 - REAL - CORNER POINTS OF THE RECTANGLE
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
```

```
C LOCAL VARIABLES:
C
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE SET DIALOG AREA LOCATION
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  02/18/89 (18:56:08)
C=====================================================================

      SUBROUTINE CMDGLC (DGID, X1, X2, Y1, Y2)

      INTEGER DGID
      REAL X1, X2, Y1, Y2

**************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
**************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

      DXLOC(DGID,1) = X1
      DXLOC(DGID,2) = X2

      DYLOC(DGID,1) = Y1
      DYLOC(DGID,2) = Y2

      RETURN
      END



C=====================================================================
C                       M O D U L E  C L D G A T
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART   :  UIE-___
C MODULE   :  _
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CLDGAT
C=====================================================================
C INPUT PARAMETERS:
C
C=====================================================================
C OUTPUT PARAMETERS:
C
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     DLGATT
C=====================================================================
C LOCAL VARIABLES:
C
C=====================================================================
```

```
C FUNCTIONAL DESCRIPTION:
C      CADMADE CLEAR  CURRENT DIALOG AREA ATTRIBUTE SETTINGS
C=====================================================================
C MODULES CALLED:
C
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C      DATE:  03/05/89 (13:45:30)
C=====================================================================

       SUBROUTINE CLDGAT

***************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
***************************************************
       INTEGER MAXN

       PARAMETER (MAXN = 5)

       INTEGER DCI(MAXN),
      >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
      >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
      >        DBSI(MAXN), DOLT(MAXN),
      >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

       REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
      >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

       COMMON /DLGATT/
      >        DCI, DFONT, DIND, DPREC, DBFLAG,
      >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
      >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
      >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

C      RESET THE ATTRIBUTES

       DO 100 I = 1, MAXN

          DCI (I)    = 1
          DFONT (I)  = 2
          DIND (I)   = 1
          DPREC (I)  = 1
          DBFLAG (I) = 1
          DOFLAG (I) = 1
          DBCI (I)   = 0
          DOCI (I)   = 1
          DBS (I)    = 1
          DBSI (I)   = 1
          DOLT (I)   = 1
          DHT (I)    = 0.02
          DSPACE (I) = 1.0
          DEXPAN (I) = 1.0
          DOW (I)    = 1.0
          DXLOC (I,1)  = -0.8
          DXLOC (I,2)  = 0.9
          DYLOC (I,1)  = -0.70
          DYLOC (I,2)  = -0.40

          DNBUF(I) = 15
          DNL(I)   = 6
          DNCHAR(I) = 80
          DMODE (I) = 1
          DVIS(I) = 1

100    CONTINUE

       RETURN
       END

C=====================================================================
C                              C A D M A D E   M O D U L E   C M M S G
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART #:
C MODULE #:
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C      CALL CMMSG(WKID, DGID, INSTR)
```

```
C=====================================================================
C INPUT PARAMETERS:
C     WKID  - INTEGER, WORKSTATION IDENTIFIER
C     DGID  - INTEGER, DIALOG AREA IDENTIFIER
C     INSTR - CHARACTER*(*), MESSAGE STRING
C=====================================================================
C OUTPUT PARAMETERS:
C     NONE
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     NLINES - INTEGER, NUMBER OF MESSAGE LINES IN TEXT ARRAY
C     TEXT(NLINES) - CHARACTER, MESSAGE STORAGE ARRAY
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     WRITES THE SPECIFIED MESSAGE ON THE SCREEN AFTER SCROLLING UP
C     ALL PREVIOUS MESSAGE LINES.
C=====================================================================
C MODULES CALLED:
C     SCRMSG - SCROLLS MESSAGE ARRAY
C     WRTMSG - WRITES NEW MESSAGE
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C            ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY MICHELE GRIESHABER
C     DATE:  09/11/87 (13:01:08)
C=====================================================================

      SUBROUTINE CMMSG(WKID, DGID, INSTR)

      INTEGER WKID, DGID
      CHARACTER*(*) INSTR

      INTEGER NLINES
      PARAMETER(NLINES = 15)

      CHARACTER*(80) TEXT(NLINES)

      DATA TEXT / '                                                ',
     >            '                                                ',
     >            '                                                ',
     >            '                                                ',
     >            '                                                ',
     >            '                                                ',
     >            '                                                ',
     >            '                                                ',
     >            '                                                ',
     >            '                                                ',
     >            '                                                ',
     >            '                                                ',
     >            '                                                ',
     >            '                                                ',
     >            '                                                '/

C     SCROLL TEXT
      CALL SCRMSG(INSTR, NLINES, TEXT)

C     PROCESS MESSAGE LINES
      CALL WRTMSG(WKID, DGID, NLINES, TEXT)

      RETURN
      END

C=====================================================================
C                    M O D U L E   S C R M S G
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART #:
C MODULE #:
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL SCRMSG(INSTR, NLINES, TEXT)
C=====================================================================
C INPUT PARAMETERS:
C     INSTR  - CHARACTER*(*), INPUT MESSAGE STRING
C     NLINES - INTEGER, NUMBER OF STRINGS IN TEXT ARRAY.
C     TEXT(NLINES) - CHARACTER*(*), MESSAGE TEXT ARRAY
```

```
C=====================================================================
C OUTPUT PARAMETERS:
C     TEXT(NLINES) - CHARACTER*(*), SCROLLED MESSAGE TEXT ARRAY
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     NONE
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     SCROLLS THE CURRENT TEXT LINES STORED IN THE ARRAY TEXT UP ONE
C     LINE AND INSERTS THE NEW INPUT STRING INTO POSITION 1.
C=====================================================================
C MODULES CALLED:
C     SFTMSG - SHIFTS THE OLD MESSAGE TEXT LINES UP ONE LINE
C     PLGMSG - PLUGS THE NEW MESSAGE INTO THE TEXT ARRAY AT POSITION 1
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C            ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  09/29/87 (14:27:55)
C=====================================================================

      SUBROUTINE SCRMSG(INSTR, NLINES, TEXT)

      INTEGER NLINES
      CHARACTER*(*) INSTR
      CHARACTER*(*) TEXT(*)

C     SHIFT TEXT LINES
      CALL SFTMSG(NLINES, TEXT)

C     PLUG IN
      CALL PLGMSG(INSTR, TEXT(1))

      RETURN
      END

C=====================================================================
C                      M O D U L E  S F T M S G
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART #:
C MODULE #:
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL SFTMSG(NLINES, TEXT)
C=====================================================================
C INPUT PARAMETERS:
C     NLINES - INTEGER, NUMBER OF MESSAGE LINES CONTAINED TEXT
C     TEXT(NLINES) - CHARACTER*(*), MESSAGE ARRAY
C=====================================================================
C OUTPUT PARAMETERS:
C     TEXT(NLINES) - CHARACTER*(*), MESSAGE ARRAY AFTER SHIFTING LINES
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     LINES - INTEGER, LINE COUNTER
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     SHIFTS THE ITH LINE OF TEXT TO THE I+1 LINE
C=====================================================================
C MODULES CALLED:
C     NONE
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C            ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  09/29/87 (14:30:33)
C=====================================================================

      SUBROUTINE SFTMSG(NLINES, TEXT)

      INTEGER NLINES
```

```
      CHARACTER*(*) TEXT(*)

      INTEGER LINE

      DO 100 LINE = NLINES, 2, -1
C       COPY PREVIOUS LINE
        TEXT(LINE) = TEXT(LINE - 1)
 100  CONTINUE

      RETURN
      END

C=====================================================================
C                    M O D U L E   P L G M S G
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART #:
C MODULE #:
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL PLGMSG(INSTR, TEXT)
C=====================================================================
C INPUT PARAMETERS:
C     INSTR - CHARACTER*(*), MESSAGE STRING TO BE COPIED TO TEXT
C=====================================================================
C OUTPUT PARAMETERS:
C     TEXT - CHARACTER*(*), NEW MESSAGE TEXT LINE
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     LTXT - INTEGER, MINIMUM OF THE LENGTH OF TEXT OR INSTR
C     I    - INTEGER, CHARACTER COUNTER
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     PLUGS NEW MESSAGE STRING INTO MESSAGE ARRAY
C=====================================================================
C MODULES CALLED:
C     NONE
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C            ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  09/29/87 (14:37:17)
C=====================================================================

      SUBROUTINE PLGMSG(INSTR, TEXT)

      CHARACTER*(*) INSTR
      CHARACTER*(*) TEXT

      INTEGER LTXT

C     CALCULATE MINIMUM STRING LENGTH
      LTXT = MIN(LEN(TEXT), LEN(INSTR))

C     COPY INPUT STRING TO TEXT STRING
      TEXT(1:LTXT) = INSTR(1:LTXT)

C     CLEAR TEXT STRING NOT OCCUPIED BY INSTR
      DO 100 I = LTXT+1, LEN(TEXT)
        TEXT(I:I) = ' '
 100  CONTINUE

      RETURN
      END

C=====================================================================
C                    M O D U L E   W R T M S G
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART #:
C MODULE #:
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
```

```
C     CALL WRTMSG(WKID, DGID, NLINES, TEXT)
C=====================================================================
C INPUT PARAMETERS:
C     WKID   - INTEGER, WORKSTATION IDENTIFIER
C     DGID   - INTEGER, DIALOG AREA IDENTIFIER
C     NLINES - INTEGER, NUMBER OF MESSAGE TEXT LINES
C     TEXT(NLINES) - CHARACTER*(*), MESSAGE TEXT ARRAY
C=====================================================================
C OUTPUT PARAMETERS:
C     NONE
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     MSGSTR - INTEGER, MESSAGE STRUCTURE IDENTIFIER
C     PRIORT - INTEGER, STRUCTURE DISPLAY PRIORITY
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     WRITES MESSAGE LINES ON SCREEN
C=====================================================================
C MODULES CALLED:
C     PEMST - PHIGS EMPTY STRUCTURE
C     POPST - PHIGS OPEN STRUCTURE
C     DRMSG - DRAW MESSAGE
C     PCLST - PHIGS CLOSE STRUCTURE
C     PPORT - PHIGS POST ROOT
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C            ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  09/29/87 (14:50:11)
C=====================================================================

      SUBROUTINE WRTMSG(WKID, DGID, NLINES, TEXT)

      INTEGER WKID, DGID, NLINES
      CHARACTER*(*) TEXT(*)

      INTEGER MSGSTR
      REAL PRIORT
      PARAMETER(PRIORT = 1.0)

      WRITE(6,*) 'DGID', DGID
C     CALCULATE THE DIALOG AREA STRUCTURE
      MSGSTR = 100000 + DGID

C     EMPTY STRUCTURE
      CALL PEMST(MSGSTR)

C     OPEN STRUCTURE
      CALL POPST(MSGSTR)

C     DRAW MESSAGE
      CALL DRMSG(DGID, NLINES, TEXT)

C     CLOSE STRUCTURE
      CALL PCLST

C     POST ROOT
      CALL PPORT(WKID, MSGSTR, PRIORT)

      RETURN
      END

C=====================================================================
C                      M O D U L E   D R M S G
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART #:
C MODULE #:
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL DRMSG(DGID, NLINES, TEXT)
C=====================================================================
C INPUT PARAMETERS:
C     DGID - INTEGER, DIALOG AREA IDENTIFIER
C     NLINES - INTEGER, NUMBER OF MESSAGE TEXT LINES
C     TEXT(NLINES) - CHARACTER*(*), MESSAGE TEXT ARRAY
```

```
C=====================================================================
C OUTPUT PARAMETERS:
C     NONE
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     VIEWI - INTEGER, MESSAGE VIEW INDEX
C     FONT  - INTEGER, MESSAGE TEXT FONT
C     CHH   - REAL, TEXT CHARACTER HEIGHT
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     INSERTS TEXT ATTRIBUTES AND DRAWS MESSAGE LINES IN THE OPEN
C     STRUCTURE
C=====================================================================
C MODULES CALLED:
C     PSVWI  - PHIGS SET VIEW INDEX
C     PSCHH  - PHIGS SET CHARACTER HEIGHT
C     PSTXFN - PHIGS SET TEXT FONT
C     DRMSTX - DRAW MESSAGE TEXT
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C            ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  09/29/87 (14:56:54)
C=====================================================================

      SUBROUTINE DRMSG(DGID, NLINES, TEXT)

      INTEGER DGID, NLINES
      CHARACTER*(*) TEXT(*)

      INTEGER VIEWI
      PARAMETER(VIEWI = 0)

C     SET VIEW INDEX
      CALL PSVWI(VIEWI)

C     DRAW MESSAGE TEXT
      CALL DRMSTX(DGID, NLINES, TEXT)

      RETURN
      END

C=====================================================================
C                    M O D U L E  D R M S T X
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART #:
C MODULE #:
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL DRMSTX(DGID, NLINES, TEXT)
C=====================================================================
C INPUT PARAMETERS:
C     DGID   - INTEGER, DIALOG AREA IDENTIFIER
C     NLINES - INTEGER, NUMBER OF MESSAGE TEXT LINES
C     TEXT(NLINES) - CHARACTER*(*), MESSAGE TEXT LINES
C=====================================================================
C OUTPUT PARAMETERS:
C     NONE
C=====================================================================
C COMMON INPUTS:
C     DLGATT
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     COLORS(10) - INTEGER, ARRAY OF TEXT COLOR INDICES
C     GAP    - REAL, SIZE OF GAP BETWEEN TEXT LINES
C     PX     - REAL, CALCULATED POSITION OF TEXT
C     PY     -
C     XBLK   - REAL, LOCATION OF LOWER LEFT CORNER OF MESSAGE BLOCK
C     YBLK   -
C     BLKHT - REAL, HEIGHT OF BLOCK IN WHICH MESSAGE LINES MUST FIT
C=====================================================================
C FUNCTIONAL DESCRIPTION:
```

```
C     DRAW THE MESSAGE TEXT LINES
C=====================================================================
C MODULES CALLED:
C     PSTXCI - PHIGS SET TEXT COLOR INDEX
C     PTX    - PHIGS TEXT
C=====================================================================
C CODED BY:  SANKAR JAYARAM
C            ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  09/29/87 (15:14:14)
C=====================================================================

      SUBROUTINE DRMSTX(DGID, NLINES, TEXT)

      INTEGER DGID, NLINES
      CHARACTER*(*) TEXT(*)

*****************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
*****************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DON(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DON, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
*********************
C END OF COMMON BLOCK
*********************
      INTEGER NPBFA
      PARAMETER (NPBFA=4)
      REAL XBFA(NPBFA), YBFA(NPBFA)

      INTEGER COLORS(10), WHITE, TEXTCL
      PARAMETER(WHITE = 7, TEXTCL = 11)

      REAL GAP, PX, PY, XBLK, YBLK, BLKHT

C     SET THE DIALOG AREA VISIBILITY
      IVIS = 126 + DVIS(DGID)
      CALL PADS (1, IVIS)

C     CHECK THE BACKGROUND FLAG
      IF (DBFLAG(DGID) .NE. 0) THEN

C     SET ALL THE FILL AREA ATTRIBUTES

            CALL PSEDFG (DOFLAG(DGID))
            CALL PSICI  (DBCI(DGID))
            CALL PSEDCI (DOCI(DGID))
            CALL PSIS   (DBS(DGID))
            CALL PSISI  (DBSI(DGID))
            CALL PSEDT  (DOLT(DGID))
********** GRAPHIGS CALL
            CALL GPESC  (DON(DGID))
**********

C           DRAW THE FILL AREA
            XBFA(1) = DXLOC(DGID,1)
            XBFA(2) = DXLOC(DGID,2)
            XBFA(3) = DXLOC(DGID,2)
            XBFA(4) = DXLOC(DGID,1)

            YBFA(1) = DYLOC(DGID,1)
            YBFA(2) = DYLOC(DGID,1)
            YBFA(3) = DYLOC(DGID,2)
            YBFA(4) = DYLOC(DGID,2)

            CALL PFA (NPBFA, XBFA, YBFA)

         ENDIF

C     CALCULATE TEXT GAP AND INITIAL TEXT POSITION
```

```
      GAP = (DYLOC(DGID,2) - DYLOC(DGID,1)) / FLOAT(DNL(DGID)+1)

      PX = DXLOC(DGID,1) + DHT(DGID)*DEXPAN(DGID)
      PY = DYLOC(DGID,1) + GAP/3.0 - DHT(DGID)

C             DUMP ALL THE TEXT ATTRIBUTES

              CALL PSTXCI (DCI(1))
              CALL PSTXFN (DFONT(1))
              CALL PSTXI  (DIND(1))
              CALL PSTXPR (DPREC(1))
              CALL PSCHH  (DHT(1))
*             CALL PSCHSP (DSPACE(1))
              CALL PSCHXP (DEXPAN(1))

              PY = PY + GAP

      DO 100 I = 1, DNL(DGID)-1
C       CALCULATE Y POSITION OF TEXT
        PY = PY + GAP
C       DRAW TEXT
        CALL PTX(PX, PY, TEXT(I))
 100  CONTINUE

      RETURN
      END
C=======================================================================
C                              C A D M A D E   M O D U L E   C M I N S T
C=======================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART #:
C MODULE #:
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CMINST(WKID, DGID, STDNR, LENT, TEXT, PET,
C    >            XMIN, XMAX, YMIN, YMAX,
C    >            LBUF, INIPOS, LDR, DATREC)
C=======================================================================
C INPUT PARAMETERS:
C     WKID - INTEGER, WORKSTATION IDENTIFIER
C     DGID - INTEGER, DIALOG AREA IDENTIFIER
C     STDNR - INTEGER, STRING DEVICE NUMBER
C     LENT  - LENGTH OF INITIAL STRING
C     TEXT - CHARACTER*(*), INITIAL (DEFAULT) CHARACTER STRING
C     PET  - INTEGER, ECHO TYPE
C     XMIN  - REAL, STRING ECHO AREA LIMITS
C     XMAX
C     YMIN
C     YMAX
C     LBUF - INTEGER, BUFFER LENGTH
C     LDR  - INTEGER, LENGTH OF DATA RECORD
C     DATREC - CHARACTER*80, DATA RECORD
C=======================================================================
C OUTPUT PARAMETERS:
C     NONE
C=======================================================================
C COMMON INPUTS:
C     DLGATT, MNUPR1, MNUPR2
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CADMADE INITIALIZES STRING INPUT DEVICE
C=======================================================================
C MODULES CALLED:
C     AQDSP - INQUIRE ACTUAL DISPLAY SIZE
C     PINST - PHIGS INITIALIZE STRING
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:
C=======================================================================

      SUBROUTINE CMINST(WKID, DGID, STDNR, LENT, TEXT, PET,
     >            XMIN, XMAX, YMIN, YMAX,
     >            LBUF, INIPOS, LDR, DATREC)

      INTEGER WKID, DGID
      CHARACTER*(*) TEXT
```

```
      INTEGER ERRIND, STDNR, PREQU, PEVENT, PECHO

      INTEGER PET, INIPOS, LDR, DATREC

      REAL RX, RY, XMIN, XMAX, YMIN, YMAX
      INTEGER DCUNIT, LX, LY

*************************************************
C START OF COMMON BLOCK FOR DIALOG AREA ATTRIBUTES
*************************************************
      INTEGER MAXN

      PARAMETER (MAXN = 5)

      INTEGER DCI(MAXN),
     >        DFONT(MAXN), DIND(MAXN), DPREC(MAXN), DBFLAG(MAXN),
     >        DOFLAG(MAXN), DBCI(MAXN), DOCI(MAXN), DBS(MAXN),
     >        DBSI(MAXN), DOLT(MAXN),
     >        DNBUF(MAXN),DNL(MAXN),DNCHAR(MAXN),DMODE(MAXN),DVIS(MAXN)

      REAL DHT(MAXN), DSPACE(MAXN), DEXPAN(MAXN),
     >     DOW(MAXN), DXLOC(MAXN,2), DYLOC(MAXN,2)

      COMMON /DLGATT/
     >        DCI, DFONT, DIND, DPREC, DBFLAG,
     >        DOFLAG, DBCI, DOCI, DBS, DBSI, DOLT,
     >        DHT, DSPACE, DEXPAN, DOW, DXLOC, DYLOC,
     >        DNBUF, DNL, DNCHAR, DMODE, DVIS
**********************
C END OF COMMON BLOCK
**********************

*************************************************************
C START OF COMMON BLOCK FOR SAVING MENU PROMPT PARAMETERS
*************************************************************
      INTEGER NMENUS
      PARAMETER (NMENUS=200)

      INTEGER MDGID(NMENUS), MPRMTL(NMENUS)
      CHARACTER*80 MPRMPT(NMENUS)

      COMMON /MNUPR1/ MDGID, MPRMTL
      COMMON /MNUPR2/ MPRMPT

**********************
C END OF COMMON BLOCK
**********************

C     INQUIRE DISPLAY SPACE SIZE
      CALL AQDSP(WKID, ERRIND, DCUNIT, RX, RY, LX, LY)

C     CALCULATE COORDINATE CONVERSION FACTORS
      XCONV = RX/2.0
      YCONV = RY/2.0

C     FIND THE ECHO AREA FOR THE DIALOG ID OF 1
      XMIN = (DXLOC(1,1) + 0.01*(DXLOC(1,2)-DXLOC(1,1)) +1)*XCONV
      YMIN = (DYLOC(1,1) + 0.01*(DYLOC(1,2)-DYLOC(1,1)) +1)*YCONV
      XMAX = RX
      YMAX = RY


C     INITIALIZE STRING
      CALL PINST(WKID, STDNR, LENT, TEXT, PET,
     >           XMIN, XMAX, YMIN, YMAX,
     >           LEN(TEXT), INIPOS, LDR, DATREC)


      RETURN
      END
C=====================================================================
C                       M O D U L E   A Q D S P
C=====================================================================
C  PROJECT:  CADMADE
C  VERSION:  X1.0.0
C   PART #:
C MODULE #:
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL AQDSP(WKID, ERRIND, DCUNIT, RX, RY, LX, LY)
C=====================================================================
```

```
C INPUT PARAMETERS:
C      WKID - INTEGER, WORKSTATION IDENTIFIER
C=====================================================================
C OUTPUT PARAMETERS:
C      ERRIND - INTEGER, ERROR INDICATOR
C      DCUNIT - INTEGER, DEVICE COORDINATE UNITS (PMETER = 0,
C               POTHU = 1)
C      RX     - INTEGER, MAXIMUM DISPLAY SURFACE SIZE (DC)
C      RY     -
C      LX     - INTEGER, MAXIMUM DISPLAY SURFACE SIZE (RASTER UNITS)
C      LY     -
C=====================================================================
C COMMON INPUTS:
C      NONE
C=====================================================================
C COMMON OUTPUTS:
C      NONE
C=====================================================================
C LOCAL VARIABLES:
C      CONID - INTEGER, WORKSTATION CONNECTION IDENTIFIER
C      WTYPE - INTEGER, WORKSTATION TYPE
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C      USED TO INQUIRE ACTUAL DISPLAY SIZE FOR A SPECIFIED WORKSTATION
C=====================================================================
C EXAMPLE(S):
C      N/A
C=====================================================================
C METHODS/ALGORITHMS:
C      N/A
C=====================================================================
C MODULES CALLED:
C      PQWKC - PHIGS INQUIRE WORKSTATION CONNECTION AND TYPE
C      PQDSP - PHIGS INQUIRE DISPLAY SPACE SIZE
C=====================================================================
C CODED BY:  TAKEN FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C      DATE:  09/15/87 (15:15:18)
C=====================================================================

      SUBROUTINE AQDSP(WKID, ERRIND, DCUNIT, RX, RY, LX, LY)

      INTEGER WKID, ERRIND, DCUNIT, LX, LY
      REAL RX, RY

      INTEGER CONID, WTYPE

C     INQUIRE WORKSTATION CONNECTION AND TYPE
      CALL PQWKC(WKID, ERRIND, CONID, WTYPE)

      IF (ERRIND .EQ. 0) THEN
C       INQUIRE DISPLAY SPACE SIZE
        CALL PQDSP(WTYPE, ERRIND, DCUNIT, RX, RY, LX, LY)
      ENDIF

      RETURN
      END
```

Appendix D. Code Listing - Sample CAD Program

This section contains a listing of the code written to implement the sample CAD program. This program also uses modules developed by Gandhi (1988) for implementing a prototype feature-based modeler. The feature-based modeling routines are not included in this listing.

```
C=======================================================================
C                        M O D U L E   F E A T U R
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALLED FROM SYSTEM
C=======================================================================
C LOCAL VARIABLES:
C     WKID - INTEGER, PRIMARY WORKSTATION IDENTIFIER
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     MAIN MODULE FOR FEATUR
C=======================================================================
C MODULES CALLED:
C     OPMAIN - OPENS FEATUR
C     DRFEAT - FEATURE BASED MODELER
C     CLMAIN - CLOSES FEATUR
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:
C=======================================================================

      PROGRAM FEATUR

      INTEGER WKID
      PARAMETER(WKID = 1)


C     OPEN WORKSTATION
      CALL OPMAIN(WKID)

C     CALL THE FEATURE BASED MODELER ROUTINES
      CALL DRFEAT(WKID)


C     CLOSE WORKSTATION
      CALL CLMAIN(WKID)

      STOP
      END

C=======================================================================
C                        M O D U L E   O P M A I N
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL OPMAIN(WKID)
C=======================================================================
C INPUT PARAMETERS:
C     WKID - INTEGER, WORKSTATION IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C     NONE
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C     ERRFIL - INTEGER, ERROR FILE IDENTIFIER
C     BUFA   - INTEGER, NUMBER OF MEMORY UNITS
C     CONID  - INTEGER, WORKSTATION CONNECTION IDENTIFIER
C     WTYPE  - INTEGER, WORKSTATION TYPE
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     OPENS FEATUR
C=======================================================================
C MODULES CALLED:
C     GWINFO - GET WORKSTATION CONNECTION ID AND TYPE
C     POPPH  - PHIGS OPEN PHIGS
C     POPWK  - PHIGS OPEN WORKSTATION
C     INITWK - INITIALIZE WORKSTATION
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C            ADAPTED FROM ACSYNT/VPI CODE WRIITEN BY STEVE WAMPLER
C     DATE:  09/01/87 (15:03:17)
C=======================================================================

      SUBROUTINE OPMAIN(WKID)
```

```
      INTEGER WKID

      INTEGER ERRFIL, BUFA
      PARAMETER(ERRFIL = 0, BUFA = 0)
      INTEGER CONID, WTYPE

C     GET WORKSTATION TYPE AND CONNECTION ID
      CALL GWINFO(WTYPE, CONID)

C     OPEN PHIGS
      CALL POPPH(ERRFIL, BUFA)

C     OPEN WORKSTATION
      CALL POPWK(WKID, CONID, WTYPE)

C     INITIALIZE WORKSTATION
      CALL INITWK(WKID)

      RETURN
      END

C=======================================================================
C                      M O D U L E  G W I N F O
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL GWINFO(WTYPE, CONID)
C=======================================================================
C INPUT PARAMETERS:
C     NONE
C=======================================================================
C OUTPUT PARAMETERS:
C     WTYPE - INTEGER, WORKSTATION TYPE
C     CONID - INTEGER, WORKSTATION CONNECTION ID
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C     NIN    - INTEGER, INPUT LOGICAL UNIT NUMBER
C     NOUT   - INTEGER, OUTPUT LOGCICAL UNIT NUMBER
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     ASK USER TO INPUT WORKSTATION TYPE AND CONNECTION ID
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY: SANKAR JAYARAM
C     DATE:
C=======================================================================

      SUBROUTINE GWINFO(WTYPE, CONID)

      INTEGER WTYPE, CONID

      INTEGER NIN, NOUT, DEFALT
      PARAMETER(NIN = 5, NOUT = 6, DEFALT = 1)

C     PROMPT FOR WORKSTATION TYPE
      WRITE(NOUT,*)'ENTER WORKSTATION TYPE (INTEGER):'

C     GET INTEGER INPUT FROM CONSOLE
      READ (NIN, *) WTYPE

C     PROMPT FOR WORKSTATION CONNECTION ID
      WRITE(NOUT,*)'ENTER WORKSTATION CONNECTION ID (INTEGER):'

C     GET INTEGER INPUT FROM CONSOLE
      READ (NIN, *) CONID

      RETURN
      END

C=======================================================================
C                      M O D U L E  I N I T W K
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
```

```
C CALLING SEQUENCE:
C     CALL INITWK(WKID)
C=====================================================================
C INPUT PARAMETERS:
C     WKID  - INTEGER, WORKSTATION IDENTIFIER
C=====================================================================
C OUTPUT PARAMETERS:
C     NONE
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     NONE
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CALLES ROUTINES TO INTIALIZE THE WORKSTATION
C=====================================================================
C MODULES CALLED:
C     INITCL - INITIALIZE WORKSTATION COLOR TABLE
C     INITIN - INITIALIZE INPUT DEVICES
C=====================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRIITEN BY STEVE WAMPLER
C     DATE:  09/01/87 (15:19:29)
C=====================================================================

      SUBROUTINE INITWK(WKID)

      INTEGER WKID

C     INITIALIZE COLORS
      CALL INITCL(WKID)

C     INITIALIZE INPUT DEVICES
      CALL INITIN(WKID)

      RETURN
      END

C=====================================================================
C                        M O D U L E  I N I T C L
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL INITCL(WKID)
C=====================================================================
C INPUT PARAMETERS:
C     WKID  - INTEGER, WORKSTATION IDENTIFIER
C=====================================================================
C OUTPUT PARAMETERS:
C     NONE
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     NCOLI - INTEGER, NUMBER COLOR INDICES TO BE DEFINED
C     CI    - INTEGER, COLOR INDEX
C     RGB( ) - REAL, RED, GREEN, BLUE COLOR VALUES FOR EACH COLOR INDEX
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     INITIALIZES WORKSTATION COLOR TABLE
C=====================================================================
C MODULES CALLED:
C     PSCMD - PHIGS SET COLOR MODEL
C     PSCR  - PHIGS SET COLOR REPRESENTATION
C=====================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRIITEN BY STEVE WAMPLER
C     DATE:  09/01/87 (15:39:10)
C=====================================================================

      SUBROUTINE INITCL(WKID)

      INTEGER WKID
```

```
      INTEGER CI, NCOLI, PRGB
      PARAMETER(NCOLI = 16, PRGB = 0)

      REAL RGB(3,NCOLI)

      DATA RGB / 0.00, 0.00, 0.00,
     >           1.00, 1.00, 1.00,
     >           1.00, 1.00, 1.00,
     >           1.00, 1.00, 1.00,
     >           1.00, 1.00, 0.00,
     >           1.00, 0.00, 1.00,
     >           0.00, 1.00, 1.00,
     >           1.00, 1.00, 1.00,
     >           1.00, 0.00, 0.00,
     >           0.00, 1.00, 0.00,
     >           0.00, 0.00, 1.00,
     >           0.00, 1.00, 1.00,
     >           0.50, 0.50, 0.50,
     >           0.00, 0.00, 0.60,
     >           0.20, 0.20, 0.20,
     >           1.00, 1.00, 0.00 /

C     SET COLOR MODEL
      CALL PSCMD(WKID, PRGB)

      DO 100 CI = 0,NCOLI-1
C       SET COLOR REPRESENTATION
        CALL PSCR(WKID, CI, RGB(1,CI+1), RGB(2, CI+1), RGB(3, CI+1))
 100  CONTINUE

      RETURN
      END

C=======================================================================
C                        M O D U L E   I N I T I N
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL INITIN(WKID)
C=======================================================================
C INPUT PARAMETERS:
C     WKID - INTEGER, WORKSTATION IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C     NONE
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C     NONE
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     INITIALIZES INPUT DEVICES
C=======================================================================
C MODULES CALLED:
C     AINVL  - INITIALIZES VALUATOR DEVICE
C     INITPK - INITIALIZES PICK DEVICE
C=======================================================================
C CODED BY: SANKAR JAYARAM
C     DATE:
C=======================================================================

      SUBROUTINE INITIN(WKID)

      INTEGER WKID

C     INITIALIZE VALUATOR DEVICES
      DO 100 IDNR = 1, 8
C       INITIALIZE VALUATOR DEVICE
        CALL AINVL(WKID, IDNR)
100   CONTINUE

C     INITIALIZE PICK DEVICE
      CALL INITPK(WKID)

      RETURN
      END
```

```
C=======================================================================
C                        M O D U L E   I N I T P K
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL INITPK(WKID)
C=======================================================================
C INPUT PARAMETERS:
C     WKID - INTEGER, WORKSTATION IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C     NONE
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     /PICKCL/ NPKCL  - INTEGER, NUMBER OF PICKABLE CLASSES
C              PKCL() - INTEGER, LIST OF PICKABLE CLASS NAMES
C=======================================================================
C LOCAL VARIABLES:
C     MAXNCL - INTEGER, MAXIMUM NUMBER OF PICKABLE CLASS NAMES
C     HPDNR  - INTEGER, PICK DEVICE NUMBER
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     INITIALIZES PICK DEVICE
C=======================================================================
C MODULES CALLED:
C     PSHPFT - PHIGS SET PICK FILTER
C     PSHPM  - PHIGS SET PICK MODE
C=======================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRIITEN BY STEVE WAMPLER
C     DATE:  02/01/88 (19:20:46)
C=======================================================================

      SUBROUTINE INITPK(WKID)

      INTEGER WKID

      COMMON /PICKCL/ NPKCL, PKCL
      INTEGER MAXNCL
      PARAMETER(MAXNCL = 255)
      INTEGER PKCL(MAXNCL)

      INTEGER HPDNR,  ESN
      PARAMETER(HPDNR = 1, ESN = 0)
      INTEGER PEVENT, PECHO
      PARAMETER(PEVENT = 2, PECHO = 1)

C     SET NUMBER OF PICKABLE CLASSES
      NPKCL = MAXNCL

      DO 100 I = 1, NPKCL
C       PUT ITH CLASS INTO PICK FILTER LIST
        PKCL(I) = I
 100  CONTINUE

C     SET PICK FILTER
      CALL PSHPFT(WKID, HPDNR, NPKCL, PKCL, ESN, ES)

C     SET PICK MODE TO EVENT
      CALL PSHPM(WKID, HPDNR, PEVENT, PECHO)

      RETURN
      END
C=======================================================================
C                        M O D U L E   C L M A I N
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CLMAIN(WKID)
C=======================================================================
C INPUT PARAMETERS:
C     WKID - INTEGER, WORKSTATION IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C     NONE
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
```

```
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     NONE
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CLOSES FEATUR
C=====================================================================
C MODULES CALLED:
C     PCLWK  - PHIGS CLOSE WORKSTATION
C     PCLPH  - PHIGS CLOSE PHIGS
C=====================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRIITEN BY STEVE HAMPLER
C     DATE:  09/01/87 (15:03:36)
C=====================================================================

      SUBROUTINE CLMAIN(WKID)

      INTEGER WKID

C     CLOSE THE WORKSTATION
      CALL PCLWK(WKID)

C     CLOSE PHIGS
      CALL PCLPH

      RETURN
      END
C=====================================================================
C                        M O D U L E   A I N V L
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL AINVL(WKID, IDNR)
C=====================================================================
C INPUT PARAMETERS:
C     WKID  - INTEGER, WORKSTATION IDENTIFIER
C     IDNR  - INTEGER, VALUATOR DEVICE NUMBER
C=====================================================================
C OUTPUT PARAMETERS:
C     NONE
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     /VALUAT/ VALUE(8) - REAL, STORAGE FOR CURRENT VALUATOR VALUES
C=====================================================================
C LOCAL VARIABLES:
C     ERRIND - INTEGER, ERROR INDICATOR RETURNED BY PQDSP
C     DCUNIT - INTEGER, DEVICE COORDINATE UNITS RETURNED BY PQDSP
C     LX     - INTEGER, MAXIMUM DISPLAY SURFACE SIZE IN RASTER UNITS
C              RETURNED BY PQDSP
C     LY     - INTEGER, MAXIMUM DISPLAY SURFACE SIZE IN RASTER UNITS
C              RETURNED BY PQDSP
C     RX     - REAL, MAXIMUM DISPLAY SURFACE SIZE IN DEVICE
C              COORDINATES RETURNED BY PQDSP
C     RY     - REAL, MAXIMUM DISPLAY SURFACE SIZE IN DEVICE
C              COORDINATES RETURNED BY PQDSP
C     XMIN   - REAL, ECHO AREA EXTENTS
C     XMAX   -
C     YMIN   -
C     YMAX   -
C     IVAL   - REAL, INITIAL VALUATOR VALUE
C     LOVAL  - REAL, LOWER LIMIT ON VALUATOR VALUE
C     HIVAL  - REAL, UPPER LIMIT ON VALUATOR VALUE
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     INITIALIZES A SPECIFIED VALUATOR DEVICE
C=====================================================================
C MODULES CALLED:
C     AQDSP - INQUIER ACTUAL DISPLAY SPACE SIZE
C     PSVLM - PHIGS SET VALUATOR MODE
C     PINVL - PHIGS INITIALIZE VALUATOR
C=====================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRIITEN BY STEVE HAMPLER
C     DATE:  09/22/87 (16:48:29)
C=====================================================================

      SUBROUTINE AINVL(WKID, IDNR)
```

```
      COMMON /VALUAT/ VALUE
      REAL VALUE(8)

      INTEGER WKID, IDNR

      INTEGER ERRIND, DCUNIT, LX, LY
      REAL RX, RY, XMIN, XMAX, YMIN, YMAX
      REAL IVAL, LOVAL, HIVAL
      PARAMETER(IVAL = 0.5, LOVAL = 0.0, HIVAL = 1.0)
      INTEGER PET, PREQU, PEVENT, PECHO, PNECHO
      PARAMETER(PET = 1, PREQU = 0, PEVENT = 2, PNECHO = 0, PECHO = 1)

C     INQUIRE DISPLAY SPACE SIZE
      CALL AQDSP(WKID, ERRIND, DCUNIT, RX, RY, LX, LY)

C     CALCULATE ECHO AREA
      XMIN = 0.0
      XMAX = RX * 0.81
      YMIN = RY * (0.95 - 0.02 * FLOAT(IDNR))
      YMAX = RY

C     INITIALIZE COMMON BLOCK
      VALUE(IDNR) = IVAL

C     SET VALUATOR MODE TO REQUEST
      CALL PSVLM(WKID, IDNR, PREQU, PNECHO)

C     INITIALIZE VALUATOR
      CALL PINVL(WKID, IDNR, IVAL, PET, XMIN, XMAX, YMIN, YMAX,
     >           LOVAL, HIVAL, 0, DUMMY)

C     SET VALUATOR MODE TO EVENT
      CALL PSVLM(WKID, IDNR, PEVENT, PNECHO)

      RETURN
      END

C=======================================================================
C                        M O D U L E   A I N S T
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL AINST(WKID, TEXT)
C=======================================================================
C INPUT PARAMETERS:
C     WKID - INTEGER, WORKSTATION IDENTIFIER
C     TEXT - CHARACTER*(*), INITIAL (DEFAULT) CHARACTER STRING
C=======================================================================
C OUTPUT PARAMETERS:
C     NONE
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C     STDNR - INTEGER, STRING DEVICE NUMBER
C     RX    - REAL, DISPLAY SIZE (DC)
C     RY
C     XMIN  - REAL, STRING ECHO AREA LIMITS
C     XMAX
C     YMIN
C     YMAX
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     INITIALIZES STRING INPUT DEVICE
C=======================================================================
C MODULES CALLED:
C     AQDSP  - INQUIRE ACTUAL DISPLAY SIZE
C     PSSTM  - PHIGS SET STRING MODE
C     CMINST - PHIGS INITIALIZE STRING
C=======================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRIITEN BY STEVE WAMPLER
C     DATE:  10/05/87 (19:42:48)
C=======================================================================

      SUBROUTINE AINST(WKID, TEXT)

      INTEGER WKID, DGID
```

```
      CHARACTER*(*) TEXT

      INTEGER ERRIND, STDNR, PREQU, PEVENT, PECHO
      PARAMETER(STDNR = 1, PREQU = 0, PEVENT = 2, PECHO = 1)

      INTEGER PET, INIPOS, LDR, DATREC
      PARAMETER(PET = 1, INIPOS = 1, LDR = 0)
      REAL RX, RY, XMIN, XMAX, YMIN, YMAX
      INTEGER DCUNIT, LX, LY

C     INQUIRE DISPLAY SPACE SIZE
      CALL AQDSP(WKID, ERRIND, DCUNIT, RX, RY, LX, LY)

C     CALCULATE ECHO AREA LIMITS
      XMIN = RX * 0.01
      XMAX = RX * 1.0
      YMIN = RY * 0.016
      YMAX = RY * 1.0


C     SET STRING MODE TO REQUEST
      CALL PSSTM(WKID, STDNR, PREQU, PECHO)

C     CADMADE INITIALIZE STRING
      CALL CMINST(WKID, DGID, STDNR, LEN(TEXT), TEXT, PET,
     >            XMIN, XMAX, YMIN, YMAX,
     >            80, INIPOS, LDR, DATREC)

C     SET STRING MODE TO EVENT
      CALL PSSTM(WKID, STDNR, PEVENT, PECHO)

      RETURN
      END

C=======================================================================
C                      M O D U L E   D R F E A T
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL DRFEAT
C=======================================================================
C INPUT PARAMETERS:
C     NONE
C=======================================================================
C OUTPUT PARAMETERS:
C     NONE
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     FEATURE BASED MODELER WITH A MENU INTERFACE
C=======================================================================
C MODULES CALLED:
C
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:
C=======================================================================

      SUBROUTINE DRFEAT (WKID)

      INTEGER WKID


      REAL LOC(3)

      INTEGER INSNUM, ASSNUM, OBJNUM, UNUM, MNUM, VIEWID, ERFILE
      REAL PRIORT
      CHARACTER*8 FNAME, ASNAME, OBNAME

C     INITIALIZE THE VARIABLES FOR THE FEATURE BASED MODELER
      INSNUM = 52
      ASSNUM = 50
```

```
      OBJNUM = 51

      ASNAME = 'ASSEMBLY'
      OBNAME = ' OBJECT '


      UNUM = 8
      WNUM = 8
      VIEWID = 1
      PRIORT = 1.0

C     SET UP THE FEATURE MENUS
      CALL FEATM

C     SET UP THE GEOMETRY VIEW
      CALL STGMVW(1)

C     OPEN THE DESIGN AND MODELING ENVIRONMENT
      CALL CMOPDM (WKID, ERFILE, FNAME)

C     INITIALIZE THE FEATURE BASED MODELER
      CALL CMIFBM (WKID, ASSNUM, OBJNUM, INSNUM, ASNAME, OBNAME,
     >                   UNUM, WNUM, VIEWID, PRIORT)


C     CALL THE MENU CONTROL ROUTINE
      CALL MCONT


      RETURN
      END

C=======================================================================
C                    M O D U L E   M C O N T
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL MCONT
C=======================================================================
C INPUT PARAMETERS:
C
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CONTROLS THE MENU FUNCTIONS
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/05/89 (14:07:17)
C=======================================================================

      SUBROUTINE MCONT

      INTEGER WKID, IPPD, IPP(3,10)
      INTEGER L, EXIT
      CHARACTER*80 STR

      EXIT = 0
      WKID = 1

C     CREATE THE MAIN MENU ROOT AND ASSOCIATED PHIGS STRUCTURES
      CALL CMCMRT (1)

C     CREATE THE UTILITY MENU ROOT AND ASSOCIATED PHIGS STRUCTURES
      CALL CMCMRT (2)

C     POST THE MAIN MENU ROOT
      CALL CMPOMN (1, 1, 1.0)

C     POST THE UTILITY MENU ROOT
```

```
      CALL CMPOMN (1, 2, 1.0)

C     UPDATE THE WORKSTATION
200   CALL PUWK(1,1)

C     CADMADE AWAIT EVENT
      CALL CMWAIT(10000., WKID, ICL, IDNR)

      IF (ICL .EQ. 5 .OR. ICL .EQ. 7) THEN


C        IF THE EVENT IS A PICK OR A MENU PICK, GET THE PICK
         CALL CMGTHP(10, ISTAT, IPPD, IPP)
C        PROCESS A MENU PICK
         IF (ICL. EQ. 7) CALL PRMNPK (WKID, IPPD, IPP, EXIT)

      ELSEIF (ICL .EQ. 6) THEN

C        PROCESS A STRING INPUT
         CALL CMGTST (L, STR)

C       HARD COPY GENERATOR
        IF (STR(1:4) .EQ. 'COPY') CALL HRDCPY (WKID, WKID+1)

      ELSEIF (ICL .EQ. 3) THEN

C       PROCESS A VALUATOR INPUT FOR VIEW TRANSFORMATIONS
        CALL PGMVL(WKID, IDNR)

      ENDIF

C     CHECK THE EXIT FLAG
      IF (EXIT .NE. 1) GO TO 200

300   RETURN
      END

C=======================================================================
C                        M O D U L E  P R M N P K
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL PRMNPK (WKID, IPPD, IPP, EXIT)
C=======================================================================
C INPUT PARAMETERS:
C
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     PROCESS A MENU PICK
C=======================================================================
C MODULES CALLED:
C     FEATURE BASED MODELING ROUTINES ARE USED IN THIS MODULE
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/05/89 (14:07:17)
C=======================================================================

      SUBROUTINE PRMNPK (WKID, IPPD, IPP, EXIT)

      INTEGER WKID, IPPD, IPP(3,10), EXIT

      REAL ASIZE(6), CSIZE(3), DATA(12), PAREA(6)
      INTEGER PPATH(3)

      REAL LOC(3), ORI(3), A, B, C, D, AR
      INTEGER COLOR, IFL, IFL1
      CHARACTER BOOL*1

C     PROCESS A MAIN MENU PICK
      IF (IPP(2, IPPD) .LT. 1000) THEN
```

```
            IF (IPP(2, IPPD) .EQ. 15) THEN

C               EXIT THE ROUTINE
                EXIT = 1

            ELSE

C               PROCESS THE MENU PICK TO DISPLAY THE NEXT MENU
                CALL CMNXMN (MKID, IPPD, IPP)

            ENDIF

        ELSEIF (IPP(2,IPPD) .GT. 1110 .AND. IPP(2, IPPD) .LT. 1120) THEN

C           CALL THE TEMPLATE FOR THE CYLINDER
            CALL MCYNDR (A, B, LOC, ORI, COLOR, BOOL)

        ELSEIF (IPP(2, IPPD) .GT. 1120 .AND. IPP(2,IPPD) .LT. 1130) THEN

C           CALL THE TEMPLATE FOR THE BUSHING
            CALL MBUSH (A, B, C, LOC, ORI, COLOR, BOOL)

        ELSEIF (IPP(2, IPPD) .GT. 1130 .AND. IPP(2,IPPD) .LT. 1140) THEN

C           CALL THE TEMPLATE FOR THE TUNNEL
            CALL MGRP4 (A, B, C, LOC, ORI, COLOR, BOOL)

        ELSEIF (IPP(2, IPPD) .GT. 1210 .AND. IPP(2,IPPD) .LT. 1220) THEN

C           CALL THE TEMPLATE FOR THE SPHERE
            CALL MSPHERE (A, LOC, COLOR, BOOL)

        ELSEIF (IPP(2, IPPD) .GT. 1220 .AND. IPP(2,IPPD) .LT. 1230) THEN

C           CALL THE TEMPLATE FOR THE HEMISPHERE
            CALL MHEMIS (A, LOC, ORI, COLOR, BOOL)

        ELSEIF (IPP(2, IPPD) .GT. 1230 .AND. IPP(2,IPPD) .LT. 1240) THEN

C           CALL THE TEMPLATE FOR THE ELLIPSOID
            CALL MELPSOD (A, B, LOC, ORI, COLOR, BOOL)

        ELSEIF (IPP(2, IPPD) .GT. 1310 .AND. IPP(2,IPPD) .LT. 1320) THEN

C           CALL THE TEMPLATE FOR THE SLAB
            CALL MSLAB (A, B, C, LOC, ORI, COLOR, BOOL)

        ELSEIF (IPP(2, IPPD) .GT. 1320 .AND. IPP(2,IPPD) .LT. 1330) THEN

C           CALL THE TEMPLATE FOR THE PRISM
            CALL MPYRMID (A, B, C, AR, IFL, LOC, ORI, COLOR, BOOL)

        ELSEIF (IPP(2, IPPD) .GT. 1330 .AND. IPP(2,IPPD) .LT. 1340) THEN

C           CALL THE TEMPLATE FOR THE WEDGE
            CALL MWEDGE (A, B, C, LOC, ORI, COLOR, BOOL)

        ELSEIF (IPP(2, IPPD) .GT. 1340 .AND. IPP(2,IPPD) .LT. 1350) THEN

C           CALL THE TEMPLATE FOR THE RING
            CALL MRING (A, B, LOC, ORI, COLOR, BOOL)

        ELSEIF (IPP(2, IPPD) .GT. 1410 .AND. IPP(2,IPPD) .LT. 1420) THEN

C           CALL THE TEMPLATE FOR THE COUNTERSINK OR COUNTERBORE
            CALL MCOUNT (A, B, C, D, IFL, IFL1, LOC, ORI, COLOR, BOOL)

        ELSEIF (IPP(2, IPPD) .GT. 1420 .AND. IPP(2,IPPD) .LT. 1430) THEN

C           CALL THE TEMPLATE FOR THE CONE
            CALL MCONE (A, B, LOC, ORI, COLOR, BOOL)

C       PROCESS A UTILITY MENU PICK
        ELSEIF (IPP(2, IPPD) .GT. 2000) THEN

C           CALL THE ERASE MODULE
            CALL MERASE (MKID, IPPD, IPP)

        ENDIF

        IF (IPP(2,IPPD) .GT. 1000 .AND. IPP(2,IPPD) .LT. 2000) THEN

C           RE-INITIALIZE THE PICK DEVICE AND THE PICK FILTERS
```

```
****** GRAPHICS CALLS
         CALL PSHPFT (1, 1, 1, 127, 1, 126)
         CALL GPQADS(1, IER, UNITS, CSIZE, ASIZE)

         PAREA(1) = 0.0
         PAREA(2) = CSIZE(1)
         PAREA(3) = 0.0
         PAREA(4) = CSIZE(2)
         PAREA(5) = 0.0
         PAREA(6) = CSIZE(3)

         CALL GPPKMO (1, 1, 1, 2)
         CALL GPINPK(1, 1, 0, PPATH, 1, PAREA, 0, DATA, 1)
         CALL GPPKMO (1, 1, 3, 2)

      ENDIF

      RETURN
      END

C=======================================================================
C                    M O D U L E  M E R A S E
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL MERASE (WKID, IPPD, IPP)
C=======================================================================
C INPUT PARAMETERS:
C
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     PROCESS A UTILITY MENU PICK
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/05/89 (14:07:17)
C=======================================================================

      SUBROUTINE MERASE (WKID, IPPD, IPP)

      INTEGER WKID, IPPD, IPP(3,10)
      INTEGER IPPD1, IPP1(3,10)

      INTEGER INSNUM, ASSNUM, OBJNUM, UNUM, MNUM, VIEWID
      REAL PRIORT
      CHARACTER*8 ASNAME, OBNAME

C     SET UP THE VARIABLES TO INITIALIZE THE FEATURE BASED MODELER
      INSNUM = 52
      ASSNUM = 50
      OBJNUM = 51

      ASNAME = 'ASSEMBLY'
      OBNAME = ' OBJECT '


      UNUM = 8
      MNUM = 8
      VIEWID = 1
      PRIORT = 1.0

C     WRITE A MESSAGE
      CALL CMMSG (WKID, 1, 'SELECT ITEM TO ERASE OR SELECT MENU')

C     UPDATE THE WORKSTATION
      CALL PUWK (WKID, 1)

C     WAIT FOR CADMADE EVENT
      CALL CMWAIT(10000., WKID, ICL, IDNR)
```

```
C     GET THE PICK
      CALL CMGTHP(10, ISTAT, IPPD1, IPP1)

      IF (ICL .EQ. 5 ) THEN

C     ERASE THE APPROPRIATE OBJECT OR INSTANCE
         IF (IPP(2,IPPD) .EQ. 2001) THEN
              CALL PEMST (IPP1(2,IPPD1))

         ELSEIF (IPP(2,IPPD) .EQ. 2002) THEN
              CALL PEMST (IPP1(2,IPPD1-1))

C        RE-INITIALIZE THE FEATURE BASED MODELER
         CALL CMIFBM (WKID, ASSNUM, OBJNUM, INSNUM, ASNAME, OBNAME,
     >                     UNUM, WNUM, VIEWID, PRIORT)

         ENDIF

      ELSEIF (ICL .EQ. 7) THEN

C        DISPLAY NEXT MENU IF A MENU WAS PICKED
         CALL CMNXMN (WKID, IPPD1, IPP1)

      ENDIF

      RETURN
      END
C=======================================================================
C                      M O D U L E   F E A T M
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL FEATM
C=======================================================================
C INPUT PARAMETERS:
C
C=======================================================================
C OUTPUT PARAMETERS:
C
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     SETS UP THE MENUS FOR FEATUR
C=======================================================================
C MODULES CALLED:
C
C=======================================================================
C CODED BY:  SANKAR JAYARAM
C     DATE:  03/05/89 (13:59:22)
C=======================================================================

      SUBROUTINE FEATM

      INTEGER LENGTH, NPTBFA, NPBFA(10), ILENGT(10), MENUID(10)
      REAL XBFA(50), YBFA(50)
      REAL XBFAT(10), YBFAT(10)
      REAL XLOC(20), YLOC(20)
      CHARACTER TITLE*12, ITEMS(10)*10
      CHARACTER PROMPT*80

      INTEGER KERFIL, WKID, HPDNR
      CHARACTER*7 FILNAM

      CHARACTER*80 CLEAR
      PARAMETER(CLEAR = ' ')

      PARAMETER (WKID = 1, HPDNR = 1)
      PARAMETER (KERFIL=90, FILNAM='MENUERR')

C     OPEN THE USER INTERFACE ENVIRONMENT
      CALL CMOPUI (WKID, HPDNR, KERFIL, FILNAM)

C     INITIALIZE STRING INPUT
      CALL AINST (WKID, CLEAR)
```

```
C     OPEN MENU STRUCTURE
      CALL CMOMST (1)

C MENU PRIMITIVES FOR MENU TITLE

C     DEFINE THE LENGTH OF THE MENU TITLE TEXT
      LENGTH = 12

C     DEFINE THE NO. OF POINTS IN THE BACKGROUND FILL AREA
      NPTBFA = 4

C     DEFINE THE BACKGROUND AREA
      XBFAT (1) = -.15
      XBFAT (2) = +.15
      XBFAT (3) = +.15
      XBFAT (4) = -.15
      YBFAT (1) = -.05
      YBFAT (2) = -.05
      YBFAT (3) = +.05
      YBFAT (4) = +.05

C     DEFINE THE TITLE TEXT
      TITLE = '   SHAPES   '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C MENU ITEMS

C     SET THE NUMBER OF MENU ITEMS
      NITEMS = 5

C     SET THE ITEM TEXT LENGTHS
      ILENGT(1) = 12
      ILENGT(2) = 12
      ILENGT(3) = 12
      ILENGT(4) = 12
      ILENGT(5) = 12
      ILENGT(6) = 12
      ILENGT(7) = 12
      ILENGT(8) = 12

C     DEFINE THE NO. OF VERTICES FOR THE FILL AREAS
      NPBFA(1) = 4
      NPBFA(2) = 4
      NPBFA(3) = 4
      NPBFA(4) = 4
      NPBFA(5) = 4
      NPBFA(6) = 4
      NPBFA(7) = 4
      NPBFA(8) = 4

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 11
      MENUID(2) = 12
      MENUID(3) = 13
      MENUID(4) = 14
      MENUID(5) = 15

C     DEFINE THE FILL AREAS
      XBFA (1) = -.15
      XBFA (2) = +.15
      XBFA (3) = +.15
      XBFA (4) = -.15
      XBFA (5) = -.15
      XBFA (6) = +.15
      XBFA (7) = +.15
      XBFA (8) = -.15
      XBFA (9) = -.15
      XBFA (10) = +.15
      XBFA (11) = +.15
      XBFA (12) = -.15
      XBFA (13) = -.15
      XBFA (14) = +.15
      XBFA (15) = +.15
      XBFA (16) = -.15
      XBFA (17) = -.15
      XBFA (18) = +.15
      XBFA (19) = +.15
      XBFA (20) = -.15
      XBFA (21) = -.15
      XBFA (22) = +.15
      XBFA (23) = +.15
```

```
      XBFA (24) = -.15
      XBFA (25) = -.15
      XBFA (26) = +.15
      XBFA (27) = +.15
      XBFA (28) = -.15
      XBFA (29) = -.15
      XBFA (30) = +.15
      XBFA (31) = +.15
      XBFA (32) = -.15

      YBFA (1) = -.05
      YBFA (2) = -.05
      YBFA (3) = +.05
      YBFA (4) = +.05
      YBFA (5) = -.05
      YBFA (6) = -.05
      YBFA (7) = +.05
      YBFA (8) = +.05
      YBFA (9) = -.05
      YBFA (10) = -.05
      YBFA (11) = +.05
      YBFA (12) = +.05
      YBFA (13) = -.05
      YBFA (14) = -.05
      YBFA (15) = +.05
      YBFA (16) = +.05
      YBFA (17) = -.05
      YBFA (18) = -.05
      YBFA (19) = +.05
      YBFA (20) = +.05
      YBFA (21) = -.05
      YBFA (22) = -.05
      YBFA (23) = +.05
      YBFA (24) = +.05
      YBFA (25) = -.05
      YBFA (26) = -.05
      YBFA (27) = +.05
      YBFA (28) = +.05
      YBFA (29) = -.05
      YBFA (30) = -.05
      YBFA (31) = +.05
      YBFA (32) = +.05

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = ' CYLINDRICAL'
      ITEMS(2) = ' ELLIPTICAL '
      ITEMS(3) = '    FLAT    '
      ITEMS(4) = '   OTHERS   '
      ITEMS(5) = '    EXIT    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT SHAPE  '
      CALL CMMPST (80, PROMPT)

C EXECUTE MENU SUB STRUCUTRES
      CALL CMEXMN(11)
      CALL CMEXMN(12)
      CALL CMEXMN(13)
      CALL CMEXMN(14)
      CALL CMEXMN(15)

C CLOSE MENU STRUCTURE
      CALL CMCMST

C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (11)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = ' CYLINDRICAL'

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     SET THE NUMBER OF MENU ITEMS
      NITEMS = 4

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 111
```

```
      MENUID(2) = 112
      MENUID(3) = 113
      MENUID(4) = -1

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '  CYLINDER   '
      ITEMS(2) = '  BUSHING    '
      ITEMS(3) = '   TUNNEL    '
      ITEMS(4) = '   RETURN    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT CYLINDRICAL SHAPE'
      CALL CMMPST (80, PROMPT)

C EXECUTE MENU SUB STRUCUTRES
      CALL CMEXMN(111)
      CALL CMEXMN(112)
      CALL CMEXMN(113)

C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (12)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = ' ELLIPTICAL '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     SET THE NUMBER OF MENU ITEMS
      NITEMS = 4

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 121
      MENUID(2) = 122
      MENUID(3) = 123
      MENUID(4) = -1

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '    SPHERE    '
      ITEMS(2) = ' HEMISPHERE   '
      ITEMS(3) = '  ELLIPSOID   '
      ITEMS(4) = '   RETURN     '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT ELLIPTICAL SHAPE'
      CALL CMMPST (80, PROMPT)

C EXECUTE MENU SUB STRUCUTRES
      CALL CMEXMN(121)
      CALL CMEXMN(122)
      CALL CMEXMN(123)

C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (13)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = '     FLAT     '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 5

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 131
      MENUID(2) = 132
      MENUID(3) = 133
```

```
      MENUID(4) = 134
      MENUID(5) = -1

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '    SLAB     '
      ITEMS(2) = '   PRISM     '
      ITEMS(3) = '   WEDGE     '
      ITEMS(4) = '    RING     '
      ITEMS(5) = '   RETURN    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT FLAT SHAPE'
      CALL CMMPST (80, PROMPT)

C EXECUTE MENU SUB STRUCUTRES
      CALL CMEXMN(131)
      CALL CMEXMN(132)
      CALL CMEXMN(133)
      CALL CMEXMN(134)

C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (14)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = '    OTHER    '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 4

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 141
      MENUID(2) = 142
      MENUID(3) = -1

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '    HOLE     '
      ITEMS(2) = '    CONE     '
      ITEMS(3) = '   RETURN    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT OTHER SHAPE'
      CALL CMMPST (80, PROMPT)

C EXECUTE MENU SUB STRUCUTRES
      CALL CMEXMN(141)
      CALL CMEXMN(142)

C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------

C     OPEN MENU STRUCTURE
      CALL CMOMST (111)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = '  CYLINDER   '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 8

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 1111
      MENUID(2) = 1112
      MENUID(3) = 1113
      MENUID(4) = 1114
```

```
      MENUID(5) = 1115
      MENUID(6) = 1116
      MENUID(7) = -1
      MENUID(8) = 0

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '    BAR     '
      ITEMS(2) = '    BEAM    '
      ITEMS(3) = '    BOSS    '
      ITEMS(4) = '  BUTTON    '
      ITEMS(5) = '    DISC    '
      ITEMS(6) = '    PIN     '
      ITEMS(7) = '  RETURN    '
      ITEMS(8) = '    ROOT    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT PARAMETER'
      CALL CMMPST (80, PROMPT)


C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (112)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = '  BUSHING   '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 8

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 1121
      MENUID(2) = 1122
      MENUID(3) = 1123
      MENUID(4) = 1124
      MENUID(5) = 1125
      MENUID(6) = 1126
      MENUID(7) = -1
      MENUID(8) = 0

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '   COLLAR   '
      ITEMS(2) = '   GASKET   '
      ITEMS(3) = '   GLAND    '
      ITEMS(4) = '  PACKING   '
      ITEMS(5) = '    PIPE    '
      ITEMS(6) = '    TUBE    '
      ITEMS(7) = '   RETURN   '
      ITEMS(8) = '    ROOT    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT PARAMETER'
      CALL CMMPST (80, PROMPT)


C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (113)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = '  TUNNEL    '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 6
```

```
C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 1131
      MENUID(2) = 1132
      MENUID(3) = 1133
      MENUID(4) = 1134
      MENUID(5) = -1
      MENUID(6) = 0

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '    RACE    '
      ITEMS(2) = '    ARCH    '
      ITEMS(3) = '    BOW     '
      ITEMS(4) = '  CRESCENT  '
      ITEMS(5) = '   RETURN   '
      ITEMS(6) = '    ROOT    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT PARAMETER'
      CALL CMMPST (80, PROMPT)


C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (121)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = '  SPHERE    '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 6

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 1211
      MENUID(2) = 1212
      MENUID(3) = 1213
      MENUID(4) = 1214
      MENUID(5) = -1
      MENUID(6) = 0

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '    BALL    '
      ITEMS(2) = '    BULB    '
      ITEMS(3) = '   GLOBULE  '
      ITEMS(4) = '  ROUNDING  '
      ITEMS(5) = '   RETURN   '
      ITEMS(6) = '    ROOT    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT PARAMETER'
      CALL CMMPST (80, PROMPT)


C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (122)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = ' HEMISPHERE '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 7

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
```

```
      MENUID(1) = 1221
      MENUID(2) = 1222
      MENUID(3) = 1223
      MENUID(4) = 1224
      MENUID(5) = 1225
      MENUID(6) = -1
      MENUID(7) = 0

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '    CUP     '
      ITEMS(2) = '    DOME    '
      ITEMS(3) = '    CAP     '
      ITEMS(4) = '   SCOOP    '
      ITEMS(5) = '   LADLE    '
      ITEMS(6) = '   RETURN   '
      ITEMS(7) = '    ROOT    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT PARAMETER'
      CALL CMMPST (80, PROMPT)


C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (123)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = '  ELLIPSOID '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 3

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 1231
      MENUID(2) = -1
      MENUID(3) = 0

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '    OVAL    '
      ITEMS(2) = '   RETURN   '
      ITEMS(3) = '    ROOT    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT PARAMETER'
      CALL CMMPST (80, PROMPT)


C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (131)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = '   SLAB     '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 7

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 1311
      MENUID(2) = 1312
      MENUID(3) = 1313
      MENUID(4) = 1314
      MENUID(5) = 1315
      MENUID(6) = -1
```

```
      MENUID(7) = 0

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '    BASE    '
      ITEMS(2) = '   BILLET   '
      ITEMS(3) = '   BLOCK    '
      ITEMS(4) = '    CUBE    '
      ITEMS(5) = '    PAD     '
      ITEMS(6) = '   RETURN   '
      ITEMS(7) = '    ROOT    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT PARAMETER'
      CALL CMMPST (80, PROMPT)


C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (132)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = '   PRISM    '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 3

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 1321
      MENUID(2) = -1
      MENUID(3) = 0

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '   PRISM    '
      ITEMS(2) = '   RETURN   '
      ITEMS(3) = '    ROOT    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT PARAMETER'
      CALL CMMPST (80, PROMPT)


C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (133)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = '   WEDGE    '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 3

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 1331
      MENUID(2) = -1
      MENUID(3) = 0

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '   WEDGE    '
      ITEMS(2) = '   RETURN   '
      ITEMS(3) = '    ROOT    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)
```

```
C     SET MENU PROMPT STRING
      PROMPT = 'SELECT PARAMETER'
      CALL CMMPST (80, PROMPT)

C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (134)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = '   RING     '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 3

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 1341
      MENUID(2) = -1
      MENUID(3) = 0

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '   RING     '
      ITEMS(2) = '   RETURN   '
      ITEMS(3) = '    ROOT    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT PARAMETER'
      CALL CMMPST (80, PROMPT)

C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------

C     OPEN MENU STRUCTURE
      CALL CMOMST (141)

C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = '   HOLE     '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 4

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 1411
      MENUID(2) = 1412
      MENUID(3) = -1
      MENUID(4) = 0

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = ' COUNTERBORE'
      ITEMS(2) = ' COUNTERSINK'
      ITEMS(3) = '   RETURN   '
      ITEMS(4) = '    ROOT    '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT PARAMETER'
      CALL CMMPST (80, PROMPT)

C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (142)
```

```
C MENU PRIMITIVES

C     DEFINE THE TITLE TEXT
      TITLE = '   CONE      '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF ITEMS
      NITEMS = 3

C     SET THE MENU IDENTIFIERS FOR THE MENU ITEMS
      MENUID(1) = 1421
      MENUID(2) = -1
      MENUID(3) = 0

C     DEFINE THE ITEM TEXT STRINGS
      ITEMS(1) = '   CONE      '
      ITEMS(2) = '   RETURN    '
      ITEMS(3) = '    ROOT     '

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT PARAMETER'
      CALL CMMPST (80, PROMPT)


C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C DEFINE THE SECOND MENU TREE
C
C     OPEN MENU STRUCTURE
      CALL CMOMST (2)

C MENU PRIMITIVES
C     SET THE NUMBER OF MENU ITEMS
      NITEMS = 1

C     SET THE MENU IDENTIFIER
      MENUID(1) = 21

C     DEFINE THE MENU ITEM TEXT
      ITEMS(1) = ' UTILITIES  '

C     SET THE MENU LOCATION
      XLOC(1) = 0.7
      YLOC(1) = -0.1
      CALL CMMILC (1, XLOC, YLOC)

C     DRAW THE MENU ITEM
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)


C EXECUTE MENU SUB STRUCUTRES
      CALL CMEXMN(21)

C CLOSE MENU STRUCTURE
      CALL CMCMST
C-----------------------------------------------------------------------
C     OPEN MENU STRUCTURE
      CALL CMOMST (21)

C     DEFINE THE MENU TITLE LOCATION
      XLOC(1) = 0.7
      YLOC(1) = -0.1
      CALL CMMTLC (XLOC(1), YLOC(1))

C MENU PRIMITIVES
C     DEFINE THE MENU TITLE TEXT
      TITLE = ' UTILITIES  '

C     DRAW THE MENU TITLE TEXT
      CALL CMMTTX (LENGTH, NPTBFA, XBFAT, YBFAT, TITLE)

C     DEFINE THE NUMBER OF MENU ITEMS
      NITEMS = 3

C     SET THE MENU IDENTIFIERS
      MENUID(1) = 2001
      MENUID(2) = 2002
      MENUID(3) = -1
```

```
C     DEFINE THE MENU ITEM TEXT STRINGS
      ITEMS(1) = 'ERASE INST. '
      ITEMS(2) = 'ERASE OBJECT'
      ITEMS(3) = '   RETURN   '

C     DEFINE THE MENU ITEM LOCATIONS
      XLOC(1) = 0.7
      YLOC(1) = -0.225
      XLOC(2) = 0.7
      YLOC(2) = -0.325
      XLOC(3) = 0.7
      YLOC(3) = -0.425
      CALL CMMILC (3, XLOC, YLOC)

C     DRAW THE MENU ITEMS
      CALL CMMITX (NITEMS, ILENGT, NPBFA, MENUID, XBFA, YBFA, ITEMS)

C     SET MENU PROMPT STRING
      PROMPT = 'SELECT UTILITY ITEM'
      CALL CMMPST (80, PROMPT)

C CLOSE MENU STRUCTURE
      CALL CMCMST
      RETURN
      END
C=======================================================================
C                      M O D U L E   A S V W M 3
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL ASVWM3(WKID, VIEWID, VALUE)
C=======================================================================
C INPUT PARAMETERS:
C     WKID   - INTEGER, WORKSTATION IDENTIFIER
C     VIEWID - INTEGER, VIEW IDENTIFIER
C     VALUE(*) - REAL, VIEW TRANSFORMATION VALUES
C=======================================================================
C OUTPUT PARAMETERS:
C     NONE
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C     MAT(4,4) - REAL, VIEW MATRIX
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     COMPUTES AND SETS A VIEW MATRIX GIVEN THE VIEW TRANSFORMATION
C     VALUES
C=======================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  09/22/87 (12:39:57)
C=======================================================================

      SUBROUTINE ASVWM3(WKID, VIEWID, VALUE)

      INTEGER WKID, VIEWID
      REAL VALUE(*)

      REAL MAT(4,4)

C     GET XFORM MATRIX
      CALL GTXFMT(VALUE, MAT)

C     SET VIEW MATRIX
      CALL PSVWM3(WKID, VIEWID, MAT)

      RETURN
      END

C=======================================================================
C                      M O D U L E   P G M V L
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL PGMVL(WKID, IDNR)
C=======================================================================
```

```
C INPUT PARAMETERS:
C     WKID   - INTEGER, WORKSTATION IDENTIFIER
C     IDNR   - INTEGER, VALUATOR DEVICE NUMBER
C=====================================================================
C OUTPUT PARAMETERS:
C     NONE
C=====================================================================
C COMMON INPUTS:
C     /GMVIEW/ CURVW - INTEGER, CURRENT GEOMETRY VIEW IDENTIFIER
C=====================================================================
C COMMON OUTPUTS:
C     /VALUAT/ VALUE( ) - REAL, STORAGE AREA FOR CURRENT VALUATOR
C                         VALUES.
C     /GMVWVL/ VWXFVL - REAL, GEOMETRY VIEW TRANSFORMATION VALUES
C=====================================================================
C LOCAL VARIABLES:
C     VLVAL - REAL, VALUATOR VALUE
C     NVALS - INTEGER, MAXIMUM NUMBER OF VALUATOR VALUES
C     MIN( ) - REAL, LIST OF LOWER LIMITS ON VIEW TRANSFORMATION VALUES
C     MAX( ) - REAL, LIST OF UPPER LIMITS ON VIEW TRANSFORMATION VALUES
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     PROCESS GEOMETRY VALUATOR
C=====================================================================
C MODULES CALLED:
C     AGTVL  - GETS VALUATOR INPUT
C     CKVLVL - CHECKS VALUATOR VALUE LIMITS
C     ASVWM3 - CALCULATES AND SETS A 3D VIEW MATRIX
C=====================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  09/17/87 (13:42:22)
C=====================================================================

      SUBROUTINE PGMVL(WKID, IDNR)

      INTEGER WKID, IDNR

      COMMON /VALUAT/ VALUE
      REAL VALUE(8)
      COMMON /GMVWVL/ VWXFVL
      REAL VWXFVL(8, 15)
      COMMON /GMVIEW/ CURVW
      INTEGER CURVW

      INTEGER NVALS
      PARAMETER(NVALS = 8)
      REAL VLVAL, MAX(NVALS), MIN(NVALS)

      DATA MIN /   0.0,   0.0,   0.0, -30.0, -30.0, -30.0,  0.1, 0.0 /
      DATA MAX / 360.0, 360.0, 360.0,  30.0,  30.0,  30.0,  5.0, 1.0 /

      CURVW = 1


C     GET VALUATOR INPUT
      CALL AGTVL(VLVAL)

C     CALCULATE NEW VIEW TRANSFORMATION VALUE
      VWXFVL(IDNR, CURVW) = VWXFVL(IDNR, CURVW)
     >                    + (VLVAL - VALUE(IDNR))
     >                    * (MAX(IDNR) - MIN(IDNR))

C     CHECK VALUATOR VALUE LIMITS
      CALL CKVLVL(WKID, IDNR, VLVAL)

C     SET VIEW MATRIX
      CALL ASVWM3(WKID, CURVW, VWXFVL(1, CURVW))

      RETURN
      END

C=====================================================================
C                    M O D U L E   S T G M V W
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL STGMVW(WKID)
C=====================================================================
C INPUT PARAMETERS:
C     WKID - INTEGER, WORKSTATION IDENTIFIER
C=====================================================================
C OUTPUT PARAMETERS:
```

```
C     NONE
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C     NVWS   - INTEGER, NUMBER OF DEFINED GEOMETRY VIEWS
C     VWID   - INTEGER, PHIGS GEOMETRY VIEW IDENTIFIER
C     ERRIND - INTEGER, ERROR INDICATOR RETURNED BY DATABASE ROUTINES
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     INITIALIZES GEOMETRY VIEWS
C=======================================================================
C MODULES CALLED:
C     STVWCS - SETS GEOMETRY VIEW CHARACTERISTICS
C     STVMP3 - SETS GEOMETRY VIEW MAPPING
C     STVWRT - SETS GEOMETRY VIEW ROOT STRUCTURE
C     STVWFM - SETS GEOMETRY VIEW FRAME ROOT STRUCTURE
C=======================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  09/22/87 (16:02:34)
C=======================================================================

      SUBROUTINE STGMVW(WKID)

      INTEGER WKID

      INTEGER NVWS, VWID, ERRIND

         VWID = 1

C       SET VIEW CHARACTERISTICS
        CALL STVWCS(WKID, VWID)

C       SET VIEW MAPPING
        CALL STVMP3(WKID, VWID)

C       SET VIEW FRAME STRUCTURE
        CALL STVWFM(WKID, VWID)

 100  CONTINUE

      RETURN
      END

C=======================================================================
C                        M O D U L E   S T V W C S
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL STVWCS(WKID, VWID)
C=======================================================================
C INPUT PARAMETERS:
C     WKID - INTEGER, WORKSTATION IDENTIFIER
C     VWID - INTEGER, PHIGS VIEW IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C     NONE
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C     IPRN   - INTEGER, INPUT PRIORITY VIEW REFERENCE NUMBER
C     RIPR   - INTEGER, RELATIVE INPUT PRIORITY
C     ACTITM - INTEGER, VIEW DATABASE ITEM NUMBER FOR VIEW ACTIVE FLAG
C     NITEMS - INTEGER, NUMBER OF DATABASE ITEMS
C     ACTIVE - INTEGER, VIEW ACTIVE FLAG
C     ERRIND - INTEGER, ERROR INDICATOR RETURNED BY DATABASE ROUTINES
C     TOPIPR - INTEGER, CURRENT TOP INPUT PRIORITY VIEW IDENTIFIER
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     SETS GEOMETRY VIEW CHARACTERISTICS
C=======================================================================
C MODULES CALLED:
C     PSVWCS - PHIGS SET VIEW CHARACTERISTICS
```

```
C=====================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  02/03/88 (21:35:54)
C=====================================================================

      SUBROUTINE STVWCS(WKID, VWID)

      INTEGER WKID, VWID

      INTEGER PNCLIP, PCLIP, PHIGHR, PLOWER
      PARAMETER(PNCLIP = 0, PCLIP = 1, PHIGHR = 0, PLOWER = 1)
      INTEGER WCLIPI, FCLIPI, BCLIPI, IPRN, RIPR
      PARAMETER(WCLIPI = PCLIP, FCLIPI = PNCLIP)
      PARAMETER(BCLIPI = PNCLIP)
      INTEGER ACTITM, NITEMS, ACTIVE, ERRIND
      PARAMETER(ACTITM = 1, NITEMS = 1)
      INTEGER TOPIPR

      DATA TOPIPR / 1 /

C     SET THE VIEW TO BE ACTIVE
      ACTIVE = 1

      IF (ACTIVE .EQ. 1) THEN
C       SET RELATIVE INPUT PRIORITY VIEW
        IPRN = TOPIPR
C       SET RELATIVE INPUT PRIORITY
        RIPR = PHIGHR
C       CHANGE TOP INPUT PRIORITY VIEW
        TOPIPR = VWID
      ELSE
C       SET RELATIVE INPUT PRIORITY VIEW
        IPRN = TOPIPR
C       SET RELATIVE INPUT PRIORITY
        RIPR = PLOWER
      ENDIF

C     SET VIEW CHARACTERISTICS
      CALL PSVWCS(WKID, VWID, WCLIPI, FCLIPI, BCLIPI, IPRN, RIPR)

      RETURN
      END

C=====================================================================
C                    M O D U L E   S T V M P 3
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL STVMP3(WKID, VWID)
C=====================================================================
C INPUT PARAMETERS:
C     WKID - INTEGER, WORKSTATION IDENTIFIER
C     VWID - INTEGER, PHIGS VIEW IDENTIFIER
C=====================================================================
C OUTPUT PARAMETERS:
C     NONE
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     PTITM  - INTEGER, VIEW DATABASE ITEM NUMBER FOR PROJECTION TYPE
C     ONE    - INTEGER, NUMBER OF PROJECTION TYPE ITEMS
C     PJTYPE - INTEGER, VIEW PROJECTION TYPE (PARALLEL OR PERSPECTIVE)
C     ERRIND - INTEGER, ERROR INDICATOR RETURNED BY DATABASE ROUTINES
C     VPITM  - INTEGER, VIEW DATABASE ITEM NUMBER FOR VIEWPORT DATA
C     NVPITM - INTEGER, NUMBER OF VIEWPORT DATA ITEMS
C     PJVPLM( ) - REAL, PROJECTION VIEWPORT LIMITS
C     VWITM  - INTEGER, VIEW DATABASE ITEM NUMBER FOR VIEW WINDOW
C              LIMITS
C     NVWITM - INTEGER, NUMBER OF VIEW WINDOW LIMIT DATA ITEMS
C     VWWNLM( ) - REAL, VIEW WINDOW LIMITS
C     PRITM  - INTEGER, VIEW DATABASE ITEM NUMBER FOR PROJECTION
C              REFERENCE POINT DATA
C     NPRITM - INTEGER, NUMBER OF PROJECTION REFERENCE POINT DATA
C              ITEMS
C     PJRP( ) - REAL, PROJECTIN REFERENCE POINT
C     PLITM  - INTEGER, VIEW DATABASE ITEM NUMBER FOR VIEW AND
C              CLIPPING PLANE DATA
```

```
C     NPLITM - INTEGER, NUMBER OF VIEW AND CLIPPING PLANE DATA ITEMS
C     PLANE( ) - REAL, VIEW PLANE AND CLIPPING PLANE DISTANCES
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     SETS GEOMETRY VIEW MAPPING
C=====================================================================
C MODULES CALLED:
C     PSVMP3 - PHIGS SET VIEW MAPPING
C     CRVWFM - CREATES VIEW FRAME STRUCTURES
C=====================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  02/01/88 (16:10:02)
C=====================================================================

      SUBROUTINE STVMP3(WKID, VWID)

      INTEGER WKID, VWID

      INTEGER PTITM, ONE, PJTYPE, ERRIND
      PARAMETER(PTITM = 3, ONE = 1)
      INTEGER VPITM, NVPITM
      PARAMETER(VPITM = 8, NVPITM = 6)
      REAL PJVPLM(NVPITM)
      INTEGER VWITM, NVWITM
      PARAMETER(VWITM = 14, NVWITM = 4)
      REAL VWWNLM(NVWITM)
      INTEGER PRITM, NPRITM
      PARAMETER(PRITM = 18, NPRITM = 3)
      REAL PJRP(NPRITM)
      INTEGER PLITM, NPLITM
      PARAMETER(PLITM = 21, NPLITM = 3)
      REAL PLANE(NPLITM)

C     SET THE PROJECTION TYPE
      PJTYPE = 0

C     SET THE VIEWPORT
      PJVPLM(1) = 0.1
      PJVPLM(2) = 0.75
      PJVPLM(3) = 0.35
      PJVPLM(4) = 0.95
      PJVPLM(5) = 0.00
      PJVPLM(6) = 1.00

C     CREATE VIEW FRAME STRUCTURES
      CALL CRVWFM(WKID, VWID, PJVPLM)

C     SET THE WINDOW
      VWWNLM(1) = -25.0
      VWWNLM(2) =  25.0
      VWWNLM(3) = -25.0
      VWWNLM(4) =  25.0

C     SET THE PROJECTION REFERENCE POINT
      PJRP(1) = 0.0
      PJRP(2) = 0.0
      PJRP(3) = 100.0

C     SET THE VIEW AND CLIPPING PLANES
      PLANE(1) = 0.0
      PLANE(2) = 70.0
      PLANE(3) = -100.0

C     SET VIEW MAPPING
      CALL PSVMP3(WKID, VWID,
     >            VWWNLM, PJVPLM,
     >            PJTYPE,
     >            PJRP(1), PJRP(2), PJRP(3),
     >            PLANE(1), PLANE(2), PLANE(3))

      RETURN
      END

C=====================================================================
C                    M O D U L E  C R V W F M
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL CRVWFM(WKID, VWID, PJVPLM)
C=====================================================================
C INPUT PARAMETERS:
C     WKID   - INTEGER, WORKSTATION IDENTIFIER
```

```
C      VWID   - INTEGER, VIEW IDENTIFIER
C      PJVPLM( ) - REAL, VIEW PROJECTION VIEWPORT LIMITS
C=====================================================================
C OUTPUT PARAMETERS:
C      NONE
C=====================================================================
C COMMON INPUTS:
C      NONE
C=====================================================================
C COMMON OUTPUTS:
C      NONE
C=====================================================================
C LOCAL VARIABLES:
C      RTITM  - INTEGER, DATABASE ITEM NUMBER FOR VIEW FRAME ROOT
C               STRUCTURE IDENTIFIER
C      NITEMS - INTEGER, NUMBER OF DATABASE ITEM NUMBERS TO BE
C               RETRIEVED
C      ROOT   - INTEGER, VIEW FRAME ROOT STRUCTURE IDENTIFIER
C      ERRIND - INTEGER, ERROR INDICATOR RETURNED BY DATABASE ROUTINES
C      SSITM  - INTEGER, DATABASE ITEM NUMBER FOR VIEW SUB-STRUCTURE
C               IDENTIFIER
C      SUBSTR - INTEGER, VIEW SUB-STRUCTURE IDENFIFIER
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C      CREATES A GEOMETRY VIEW FRAME STRUCTURE
C=====================================================================
C MODULES CALLED:
C      CRMNRT - CREATES A MENU ROOT STRUCTURE
C      CRVFSS - CREATES A VIEW FRAME SUB-STRUCTURE
C=====================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE HAMPLER
C      DATE:  02/17/88 (19:14:32)
C=====================================================================

       SUBROUTINE CRVWFM(WKID, VWID, PJVPLM)

       INTEGER WKID, VWID
       REAL    PJVPLM(*)

       INTEGER RTITM, NITEMS, ROOT, ERRIND
       PARAMETER(RTITM = 6, NITEMS = 1)
       INTEGER SSITM, SUBSTR
       PARAMETER(SSITM = 7)
       INTEGER VIEW1, PICKID
       PARAMETER(VIEW1 = 0, PICKID = 5)

       ROOT = 25
       SUBSTR = 26


C      CREATE VIEW FRAME MENU ROOT
       CALL CRMNRT(ROOT, VIEW1, PICKID, SUBSTR)

C      CREATE VIEW FRAME SUB-STRUCTURE
       CALL CRVFSS(VWID, SUBSTR, PJVPLM)

       RETURN
       END

C=====================================================================
C                        M O D U L E   C R V F S S
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C      CALL CRVFSS(VWID, SUBSTR, PJVPLM)
C=====================================================================
C INPUT PARAMETERS:
C      VWID   - INTEGER, GEOMETRY VIEW IDENTIFIER
C      SUBSTR - INTEGER, SUB-STRUCTURE IDENTIFIER
C      PJVPLM( ) - REAL, PROJECTION VIEWPORT LIMITS
C=====================================================================
C OUTPUT PARAMETERS:
C      NONE
C=====================================================================
C COMMON INPUTS:
C      NONE
C=====================================================================
C COMMON OUTPUTS:
C      NONE
C=====================================================================
C LOCAL VARIABLES:
C      N - INTEGER, NUMBER OF CLASS NAMES
```

```
C     NAMSET( ) - INTEGER, LIST OF CLASS NAMES
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CREATES A VIEW FRAME SUB-STRUCTURE
C=====================================================================
C MODULES CALLED:
C     PEMST  - PHIGS EMPTY STRUCTURE
C     POPST  - PHIGS OPEN STRUCTURE
C     PADS   - PHIGS ADD NAMES TO SET
C     PSHPID - PHIGS SET PICK IDENTIFIER
C     DRVWFM - DRAWS VIEW FRAME ELEMENTS
C     DRVWPK - DRAWS VIEW PICK ELEMENTS
C     PCLST  - PHIGS CLOSE STRUCTURE
C=====================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:
C=====================================================================

      SUBROUTINE CRVFSS(VWID, SUBSTR, PJVPLM)

      INTEGER VWID, SUBSTR
      REAL    PJVPLM(*)

      INTEGER N
      PARAMETER(N = 1)
      INTEGER NAMSET(N)

      DATA NAMSET / 255 /

C     EMPTY SUBSTRUCTURE
      CALL PEMST(SUBSTR)

C     OPEN SUBSTRUCTURE
      CALL POPST(SUBSTR)

C     ADD CLASS NAME TO SET
      CALL PADS(N, NAMSET)

C     SET PICK IDENTIFIER
      CALL PSHPID(VWID)

C     DRAW FRAME
      CALL DRVWFM(PJVPLM)

C     DRAW VIEW PICK ITEM
      CALL DRVWPK(VWID, PJVPLM)

C     CLOSE STRUCTURE
      CALL PCLST

      RETURN
      END

C=====================================================================
C                        M O D U L E  D R V W F M
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL DRVWFM(PJVPLM)
C=====================================================================
C INPUT PARAMETERS:
C     PJVPLM( ) - REAL, PROJECTION VIEW PORT LIMITS
C=====================================================================
C OUTPUT PARAMETERS:
C     NONE
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     NPNTS - INTEGER, NUMBER OF POLYLINE POINTS
C     FRAME - INTEGER, VIEW FRAME COLOR IDENTIFIER
C     FRAMEX( ) - REAL, VIEW FRAME VERTICE X COORDINATES
C     FRAMEY( ) - REAL, VIEW FRAME VERTICE Y COORDINATES
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     DRAWS A VIEW FRAME AROUND THE SPECIFIED VIEW PORT
C=====================================================================
C MODULES CALLED:
```

```
C     PSPLCI - PHIGS SET POLYLINE COLOR INDEX
C     PPL    - PHIGS POLYLINE
C=====================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  02/18/88 (10:13:34)
C=====================================================================

      SUBROUTINE DRVWFM(PJVPLM)

      REAL PJVPLM(*)

      INTEGER NPNTS, FRAME
      PARAMETER(NPNTS = 5, FRAME = 15)
      REAL FRAMEX(NPNTS), FRAMEY(NPNTS)

C     SET POLYLINE COLOR INDEX
      CALL PSPLCI(FRAME)

C     CALCULATE VIEW FRAME X COORDINATES
      FRAMEX(1) = PJVPLM(1)*2.0 - 1.0
      FRAMEX(2) = PJVPLM(2)*2.0 - 1.0
      FRAMEX(3) = PJVPLM(2)*2.0 - 1.0
      FRAMEX(4) = PJVPLM(1)*2.0 - 1.0
      FRAMEX(5) = PJVPLM(1)*2.0 - 1.0

C     CALCULATE VIEW FRAME Y COORDINATES
      FRAMEY(1) = PJVPLM(3)*2.0 - 1.0
      FRAMEY(2) = PJVPLM(3)*2.0 - 1.0
      FRAMEY(3) = PJVPLM(4)*2.0 - 1.0
      FRAMEY(4) = PJVPLM(4)*2.0 - 1.0
      FRAMEY(5) = PJVPLM(3)*2.0 - 1.0

C     DRAW POLYLINE
      CALL PPL(NPNTS, FRAMEX, FRAMEY)

      RETURN
      END

C=====================================================================
C                    M O D U L E   D R V W P K
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
C CALLING SEQUENCE:
C     CALL DRVWPK(VWID, PJVPLM)
C=====================================================================
C INPUT PARAMETERS:
C     VWID   - INTEGER, VIEW IDENTIFIER
C     PJVPLM( ) - REAL, PROJECTION VIEW PORT LIMIT
C=====================================================================
C OUTPUT PARAMETERS:
C     NONE
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     TTLITM - INTEGER, DATABASE ITEM NUMBER FOR VIEW TITLE TEXT
C     ERRIND - INTEGER, ERROR INDICATOR RETURNED BY DATABASE ROUTINE
C     TEXT   - CHARACTER, VIEW TITLE TEXT
C     PX     - REAL, VIEW TITLE TEXT X POSITION
C     PY     - REAL, VIEW TITLE TEXT Y POSITION
C     XSHFT  - REAL, VIEW TITLE TEXT X POSITION SHIFT VALUE
C     YSHFT  - REAL, VIEW TITLE TEXT Y POSITION SHIFT VALUE
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     DRAWS A VIEW PICK ELEMENT
C=====================================================================
C MODULES CALLED:
C     MNUATB - INSERTS ELEMENT ATTRIBUTES INTO THE OPEN STRUCTURE
C     PTX    - PHIGS TEXT
C=====================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  02/18/88 (10:26:12)
C=====================================================================

      SUBROUTINE DRVWPK(VWID, PJVPLM)

      INTEGER VWID
```

```
      REAL    PJVPLM(*)
      INTEGER TTLITM, ERRIND
      PARAMETER(TTLITM = 1)
      CHARACTER*20 TEXT
      REAL PX, PY, XSHFT, YSHFT
      PARAMETER(XSHFT = 0.025, YSHFT = 0.025)

C     SET THE VIEW IDENTIFIER TEXT
      TEXT = 'GEOEMTRY VIEW'

C     CALCULATE TEXT POSITION
      PX = (PJVPLM(1) + XSHFT)*2.0 - 1.0
      PY = (PJVPLM(3) + YSHFT)*2.0 - 1.0

C     DRAW TEXT
      CALL PTX(PX, PY, TEXT)

      RETURN
      END

C=======================================================================
C                       M O D U L E  S T V W F M
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL STVWFM(WKID, VWID)
C=======================================================================
C INPUT PARAMETERS:
C     WKID - INTEGER, WORKSTATION IDENTIFIER
C     VWID - INTEGER, VIEW IDENTIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C     NONE
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C     VFITM  - INTEGER, DATABASE ITEM NUMBER FOR VIEW FRAME ROOT
C              STRUCTURE IDENTIFIER
C     NITEMS - INTEGER, NUMBER OF DATABASE ITEMS TO BE RETRIEVED
C     ROOT   - INTEGER, VIEW FRAME ROOT STRUCTURE IDENTIFIER
C     ERRIND - INTEGER, ERROR INDICATOR RETURNED BY DATABASE ROUTINES
C     ACTITM - INTEGER, DATABASE ITEM NUMBER FOR VIEW ACTIVE FLAG
C     ACTIVE - INTEGER, VIEW ACTIVE FLAG (0 = INACTIVE, 1 = ACTIVE)
C     PRIORT - REAL, STRUCTURE DISPLAY PRIORITY
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     POSTS OR UNPOSTS A GEOMETRY VIEW FRAME DEPENDING UPON WHETHER
C     THE VIEW IS ACTIVE OR INACTIVE RESPECTIVELY
C=======================================================================
C MODULES CALLED:
C     PPORT  - PHIGS POST ROOT
C     PUPORT - PHIGS UNPOST ROOT
C=======================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  02/18/88 (10:33:04)
C=======================================================================

      SUBROUTINE STVWFM(WKID, VWID)

      INTEGER WKID, VWID

      INTEGER VFITM, NITEMS, ROOT, ERRIND
      PARAMETER(VFITM = 6, NITEMS = 1)
      INTEGER ACTITM, ACTIVE
      PARAMETER(ACTITM = 1)
      REAL    PRIORT
      PARAMETER(PRIORT = 1.0)

      ROOT = 25
      ACTIVE = 1

      IF (ACTIVE .EQ. 1) THEN
C       POST ROOT
        CALL PPORT(WKID, ROOT, PRIORT)
      ELSE
C       UNPOST ROOT
        CALL PUPORT(WKID, ROOT)
```

```
      ENDIF

      RETURN
      END
C=======================================================================
C                        M O D U L E   C R M N R T
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL CRMNRT(ROOT, VIEWID, PICKID, SUBSTR)
C=======================================================================
C INPUT PARAMETERS:
C     ROOT   - INTEGER, MENU ROOT STRUCTURE IDENTIFIER
C     VIEWID - INTEGER, MENU VIEW IDENTIFIER
C     PICKID - INTEGER, MENU TYPE PICK IDENTIFIER
C     SUBSTR - INTEGER, MENU SUB-STRUCTURE IDENFIFIER
C=======================================================================
C OUTPUT PARAMETERS:
C     NONE
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C     NONE
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CREATES A MENU ROOT STRUCTURE WHICH EXECUTES A SUB-STRUCTURE
C     CONTAINING THE ACTUAL MENU ITEMS.
C=======================================================================
C MODULES CALLED:
C     PEMST  - PHIGS EMPTY STRUCTURE
C     POPST  - PHIGS OPEN STRUCTURE
C     PSVWI  - PHIGS SET VIEW IDENTIFIER
C     PSHPID - PHIGS SET PICK ID
C     PEXST  - PHIGS EXECUTE STRUCTURE
C     PCLST  - PHIGS CLOSE STRUCTURE
C=======================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  02/18/88 (08:59:30)
C=======================================================================

      SUBROUTINE CRMNRT(ROOT, VIEWID, PICKID, SUBSTR)

      INTEGER ROOT, VIEWID, PICKID, SUBSTR

C     EMPTY ROOT STRUCTURE
      CALL PEMST(ROOT)

C     OPEN ROOT STRUCTURE
      CALL POPST(ROOT)

C     SET VIEW INDEX
      CALL PSVWI(VIEWID)

C     SET PICK IDENTIFIER
      CALL PSHPID(PICKID)

C     EXECUTE SUB-STRUCTURE
      CALL PEXST(SUBSTR)

C     CLOSE ROOT
      CALL PCLST

      RETURN
      END
C=======================================================================
C                      M O D U L E   G T X F M T
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL GTXFMT(VALUE, MAT)
C=======================================================================
C INPUT PARAMETERS:
C     VALUE(*) - REAL, TRANSFORMATION VALUES AS FOLLOWS:
C                   VALUE(1) = X AXIS ROTATION IN DEGREES
C                   VALUE(2) = Y AXIS ROTATION IN DEGREES
C                   VALUE(3) = Z AXIS ROTATION IN DEGREES
```

```
C                   VALUE(4) = TRANSLATION ALONG X AXIS
C                   VALUE(5) = TRANSLATION ALONG Y AXIS
C                   VALUE(6) = TRANSLATION ALONG Z AXIS
C                   VALUE(7) = SCALE FACTOR
C=====================================================================
C OUTPUT PARAMETERS:
C     MAT(4,4) - REAL, TRANSFORMATION MATRIX
C=====================================================================
C COMMON INPUTS:
C     NONE
C=====================================================================
C COMMON OUTPUTS:
C     NONE
C=====================================================================
C LOCAL VARIABLES:
C     GAMMA - REAL, X AXIS ROTATION ANGLE IN RADIANS
C     BETA  - REAL, Y AXIS ROTATION ANGLE IN RADIANS
C     ALPHA - REAL, Z AXIS ROTATION ANGLE IN RADIANS
C     CA    - REAL, COSINE OF ALPHA
C     CB    - REAL, COSINE OF BETA
C     CG    - REAL, COSINE OF GAMMA
C     SA    - REAL, SINE OF ALPHA
C     SB    - REAL, SINE OF BETA
C     SG    - REAL, SINE OF GAMMA
C=====================================================================
C FUNCTIONAL DESCRIPTION:
C     CALCULATES A 3D TRANSFORAMTION MATRIX
C=====================================================================
C MODULES CALLED:
C     NONE
C=====================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  09/22/87
C=====================================================================

      SUBROUTINE GTXFMT(VALUE, MAT)

      REAL VALUE(*), MAT(4,4)

      REAL PI, DG2RD
      PARAMETER(PI = 3.14159, DG2RD = PI / 180.0)
      REAL GAMMA, BETA, ALPHA
      REAL CA, CB, CG, SA, SB, SG

C     CONVERT DEGREES TO RADIANS
      GAMMA = VALUE(1) * DG2RD
      BETA  = VALUE(2) * DG2RD
      ALPHA = VALUE(3) * DG2RD

C     CALCULATE SINES AND COSINES
      CA = COS(ALPHA)
      CB = COS(BETA)
      CG = COS(GAMMA)
      SA = SIN(ALPHA)
      SB = SIN(BETA)
      SG = SIN(GAMMA)

C     CALCULATE XFORM MATRIX
      MAT(1,1) = (CA * CB) * VALUE(7)
      MAT(1,2) = (CA * SB * SG - SA * CG) * VALUE(7)
      MAT(1,3) = (CA * SB * CG + SA * SG) * VALUE(7)
      MAT(1,4) = VALUE(4) * VALUE(7)
      MAT(2,1) = (SA * CB) * VALUE(7)
      MAT(2,2) = (SA * SB * SG + CA * CG) * VALUE(7)
      MAT(2,3) = (SA * SB * CG - CA * SG) * VALUE(7)
      MAT(2,4) = VALUE(5) * VALUE(7)
      MAT(3,1) = (-SB) * VALUE(7)
      MAT(3,2) = (CB*SG) * VALUE(7)
      MAT(3,3) = (CB*CG) * VALUE(7)
      MAT(3,4) = VALUE(6) * VALUE(7)
      MAT(4,1) = 0.0
      MAT(4,2) = 0.0
      MAT(4,3) = 0.0
      MAT(4,4) = 1.0

      RETURN
      END

C=====================================================================
C                       M O D U L E  C K V L V L
C=====================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=====================================================================
```

```
C CALLING SEQUENCE:
C     CALL CKVLVL(WKID, VLDNR, VLVAL)
C=======================================================================
C INPUT PARAMETERS:
C     WKID  - INTEGER, WORKSTATION IDENTIFIER
C     VLDNR - INTEGER, VALUATOR DEVICE NUMBER
C     VLVAL - INTEGER, CURRENT VALUATOR VALUE
C=======================================================================
C OUTPUT PARAMETERS:
C     NONE
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     /VALUAT/ VALUE( ) - REAL, CURRENT VALUATOR VALUES
C=======================================================================
C LOCAL VARIABLES:
C     NONE
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     CHECKS THE VALUE OF A SPECIFIED VALUATOR
C=======================================================================
C MODULES CALLED:
C     AINVL - INITIALIZES VALUATOR DEVICE
C=======================================================================
C CODED BY: SANKAR JAYARAM
C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  02/03/88 (10:10:09)
C=======================================================================

      SUBROUTINE CKVLVL(WKID, VLDNR, VLVAL)

      INTEGER WKID, VLDNR
      REAL VLVAL

      COMMON /VALUAT/ VALUE
      REAL VALUE(8)

      IF (VLVAL .EQ. 0.0 .OR. VLVAL .EQ. 1.0) THEN
C       INITIALIZE VALUATOR
        CALL AINVL(WKID, VLDNR)
      ELSE
C       STORE CURRENT VALUATOR VALUE IN COMMON BLOCK
        VALUE(VLDNR) = VLVAL
      ENDIF

      RETURN
      END

C=======================================================================
C                          M O D U L E  A G T V L
C=======================================================================
C COMPILER:  FORTVS2 (FORTRAN 77)
C=======================================================================
C CALLING SEQUENCE:
C     CALL AGTVL(VLVAL)
C=======================================================================
C INPUT PARAMETERS:
C     NONE
C=======================================================================
C OUTPUT PARAMETERS:
C     VLVAL - REAL, VALUATOR VALUE
C=======================================================================
C COMMON INPUTS:
C     NONE
C=======================================================================
C COMMON OUTPUTS:
C     NONE
C=======================================================================
C LOCAL VARIABLES:
C     TOUT  - REAL, TIMEOUT VALUE FOR AWAIT EVENT SUBROUTINE
C     IWKID - REAL, INPUT WORKSTATION IDENTIFIER (RETURNED BY PWAIT)
C     ICL   - REAL, INPUT DEVICE CLASS (RETURNED BY PWAIT)
C     IDNR  - REAL, INPUT DEVICE NUMBER (RETURNED BY PWAIT)
C=======================================================================
C FUNCTIONAL DESCRIPTION:
C     RETURNS LAST VALUATOR VALUE FROM A SEARIES OF VALUATOR EVENTS
C=======================================================================
C MODULES CALLED:
C     PGTVL - PHIGS GET VALUATOR
C     PWAIT - PHIGS AWAIT EVENT
C=======================================================================
C CODED BY: SANKAR JAYARAM
```

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C           ADAPTED FROM ACSYNT/VPI CODE WRITTEN BY STEVE WAMPLER
C     DATE:  12/07/87 (19:57:55)
C=================================================================

      SUBROUTINE AGTVL(VLVAL)

      REAL VLVAL

      REAL TOUT
      PARAMETER(TOUT = 0.2)
      INTEGER IWKID, ICL, IDNR

      INTEGER PVALUA
      PARAMETER(PVALUA = 3)

C     GET VALUATOR EVENT
 100  CALL PGTVL(VLVAL)

C     AWAIT EVENT TO SEE IF ANY MORE EVENTS A QUEUED
      CALL PWAIT(TOUT, IWKID, ICL, IDNR)

      IF (ICL .EQ. PVALUA) THEN
C       LOOP BACK TO SEE IF THERE ARE MORE EVENTS
        GOTO 100
      ENDIF

      RETURN
      END
```

The vita has been removed from the scanned document