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Software Management Environment (SME) Release 9.4
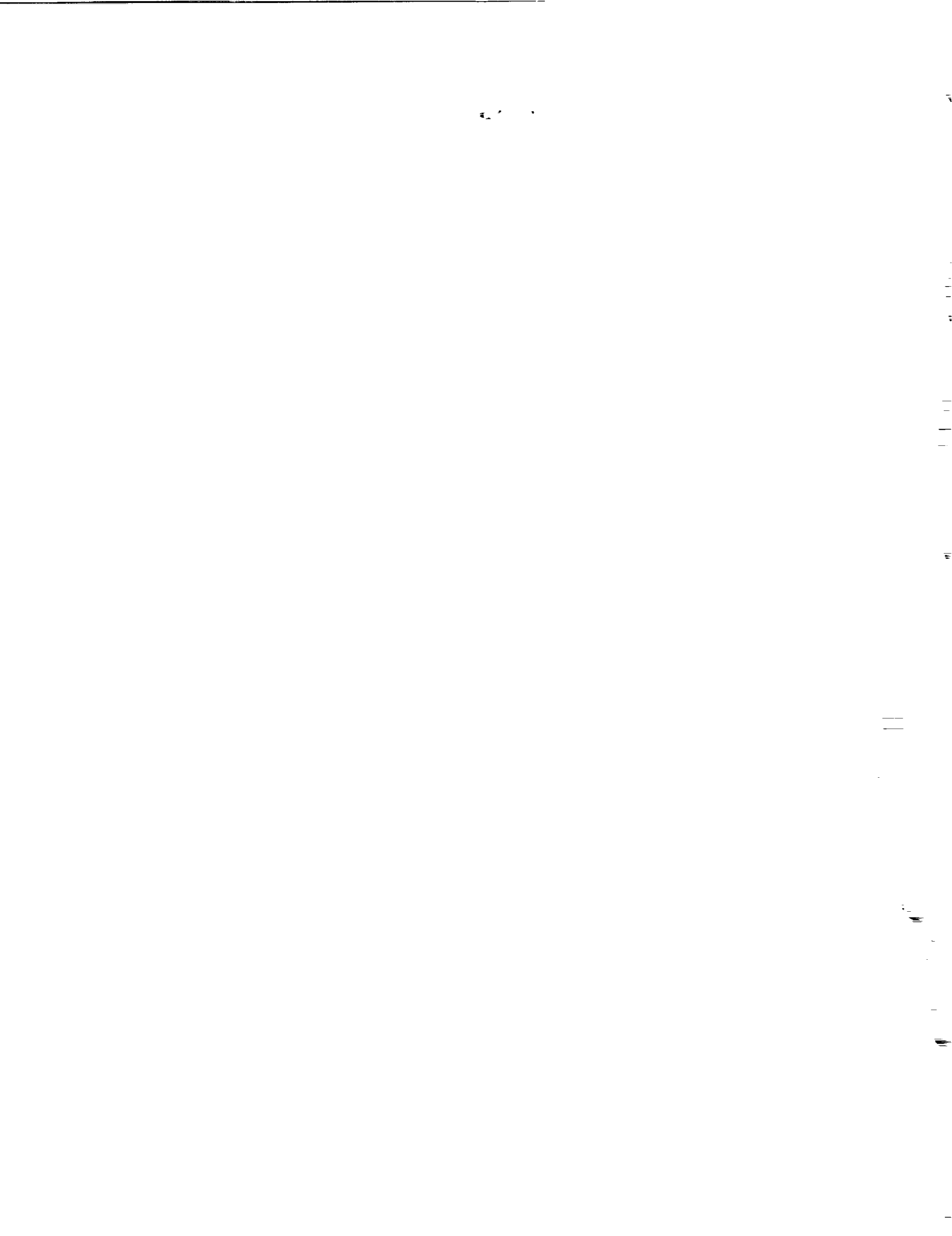
User Reference Material

September 1992

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Goddard Space Flight Center
Flight Dynamics Division / Code 550
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552-FDD-91/067R0UD0
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SOFTWARE MANAGEMENT ENVIRONMENT (SME)
RELEASE 9.4

USER REFERENCE MATERIAL

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FLIGHT DYNAMICS DIVISION

CODE 550

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                             Contract NAS 5-31500
                             Computer Sciences Corporation

SOFTWARE MANAGEMENT ENVIRONMENT (SME)
RELEASE 9.4

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September 1992

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PREFACE

Because of the evolutionary nature of the Software Management
Environment (SME) prototype, this document is being issued in
draft form to serve as a working reference for conveying up-
to-date user information. The material will be updated, as
necessary, for new releases of the software and will be
issued in the future as a formal user's guide.

Questions concerning this document or proposed changes shall
be addressed to

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ABSTRACT

This document contains user reference material for the
Software Management Environment (SME) prototype, developed
for the Systems Development Branch (Code 552) of the Flight
Dynamics Division (FDD) of Goddard Space Flight Center
(GSFC). The SME provides an integrated set of management
tools that can be used by software development managers in
their day-to-day management and planning activities. This
document provides an overview of the SME, a description of
all functions, and detailed instructions concerning the
software's installation and use.

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SECTION 1 - INTRODUCTION

This document presents user reference material for Release
9.4 of the Software Management Environment (SME). The SME is
being developed for the Systems Engineering Branch (Code 552)
of the Flight Dynamics Division of Goddard Space Flight
Center (GSFC). The SME's purpose is to provide an integrated
set of management tools that can assist software development
managers in their day-to-day management and planning
activities.

The SME software resides on the Systems Technology Laboratory
(STL) disk STL_DISK1 in directory SME, and is available on
the STL VAX 11/780 and 8820 computers. A valid STL VAX
account, an IBM personal computer (PC) or compatible PC with
an enhanced graphics adapter (EGA) color monitor, support for
serial asynchronous communications, and a copy of the SME PC
communications program are required to run the SME.

The information in this document is organized as follows:
the remainder of this section presents a brief overview of
the SME. Section 2 contains step-by-step instructions for
installing the SME communications program on a PC workstation
and accessing the VAX-resident portion of the software.
Section 3 provides information regarding the use of menus,
selection lists, display lists, and data entry screens that
appear throughout the system. Section 4 presents general
instructions for entering the SME and provides a description
of the SME executive level functions. Sections 5, 6, 7, and
8 present detailed descriptions of the SME growth monitor,
rate monitor, planning, and overall assessment functions,

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respectively. Section 9 presents a detailed description of the SME display options.

1.1 FUNCTIONAL OVERVIEW

The SME provides a set of tools that can help software development managers in their typical management and planning activities. The SME consists of an executive structure and these major functions: growth monitor, rate monitor, overall assessment, and planning. Additionally, each function contains several subfunctions which will be described in later sections of this document. These functions use as input data obtained from the Software Engineering Laboratory (SEL) to provide the user with plots of a single project's performance over a period of time.

1.1.1 GROWTH MONITOR OVERVIEW

The growth monitor allows software development managers to view and analyze a project's performance. The growth monitor obtains input from data files (schedules, estimates, performance, and profile data for measures) and provides the user with plots of a single project's data for a given measure as a function of time. Guidelines derived from models of the software development process are displayed on the growth monitor plot and can be used to observe deviations from expected project performance.

The growth comparison function permits data for a given measure from one or more different projects to be scaled and displayed on the same plot. This feature permits the user to

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readily compare a project's performance with other similar projects.

The predict function allows the user to predict the growth of individual performance measures.

The profile function allows the user to examine a particular growth measure in greater detail by breaking down the measure into specific distributions, or components. Guidelines are displayed that enable the user to observe deviations from expected project performance.

The assess function allows the user to view possible or known explanations for a project's deviation from an expected range.

The estimate function of the growth monitor allows the user to display (either graphically or in tabular form) a history of the manager's estimates for a given measure.

1.1.2 RATE MONITOR OVERVIEW

The rate monitor enables managers to view and analyze the ratio of any two individual performance measures that are available for a given project. The rate monitor obtains input from data files and plots the cumulative ratio of the measures as a function of time. Guidelines for this ratio may be derived from the two individual measures and displayed on the plot to observe deviations from the project's expected performance.

When the SME is run in the expert mode (allowing access to
the expert system capabilities of the LISP interpreter), the
rate monitor assess option provides a general analysis of
project trends. Specific project measure ratios are examined
and a list of possible explanations for deviations from
expected values is displayed. A corresponding certainty
value is presented for each explanation.

The rate comparison function permits ratios of two measures
for one or more different projects to be scaled and displayed
on the same plot. As with the growth comparison function,
this feature enables the user to compare a project's
performance with other similar projects.

The estimate function of the rate monitor allows the user to
display (either graphically or in tabular form) a history of
ratios of the manager's estimates for a given measure.

1.1.3 PLANNING FUNCTION OVERVIEW

The planning function enables managers to change schedules
and estimate values for project measures interactively.
Since a project plan consists of a schedule and a set of
estimates, this function allows the user to create and use
alternative plans. The planning function is also useful for
creating "what if" scenarios.

1.1.4 OVERALL ASSESSMENT OVERVIEW

The overall assessment feature enables managers to view and
analyze an assessment of general project qualities such as
maintainability and correctability. The function interprets

current project data and reaches conclusions about the overall product and project quality.

The overall assessment examine function permits the user to further investigate the strengths and weaknesses of a project by displaying the underlying factors associated with a given attribute.

1.1.5 MENU HIERARCHY OVERVIEW

The functions described above are grouped logically into a series of menus to provide a basis for user interaction with the SME. These menus are organized into a hierarchy that reflects the functional architecture of the system. The SME executive menu enables the user to invoke the growth monitor, rate monitor, overall assessment, and planning functions. The growth monitor menu enables the user to invoke the comparison, predict, profile, assess, and estimate functions of the growth monitor. Similarly, the rate monitor menu provides access to the comparison, assess, and estimate functions of the rate monitor. Figure 1-1 depicts this menu hierarchy.
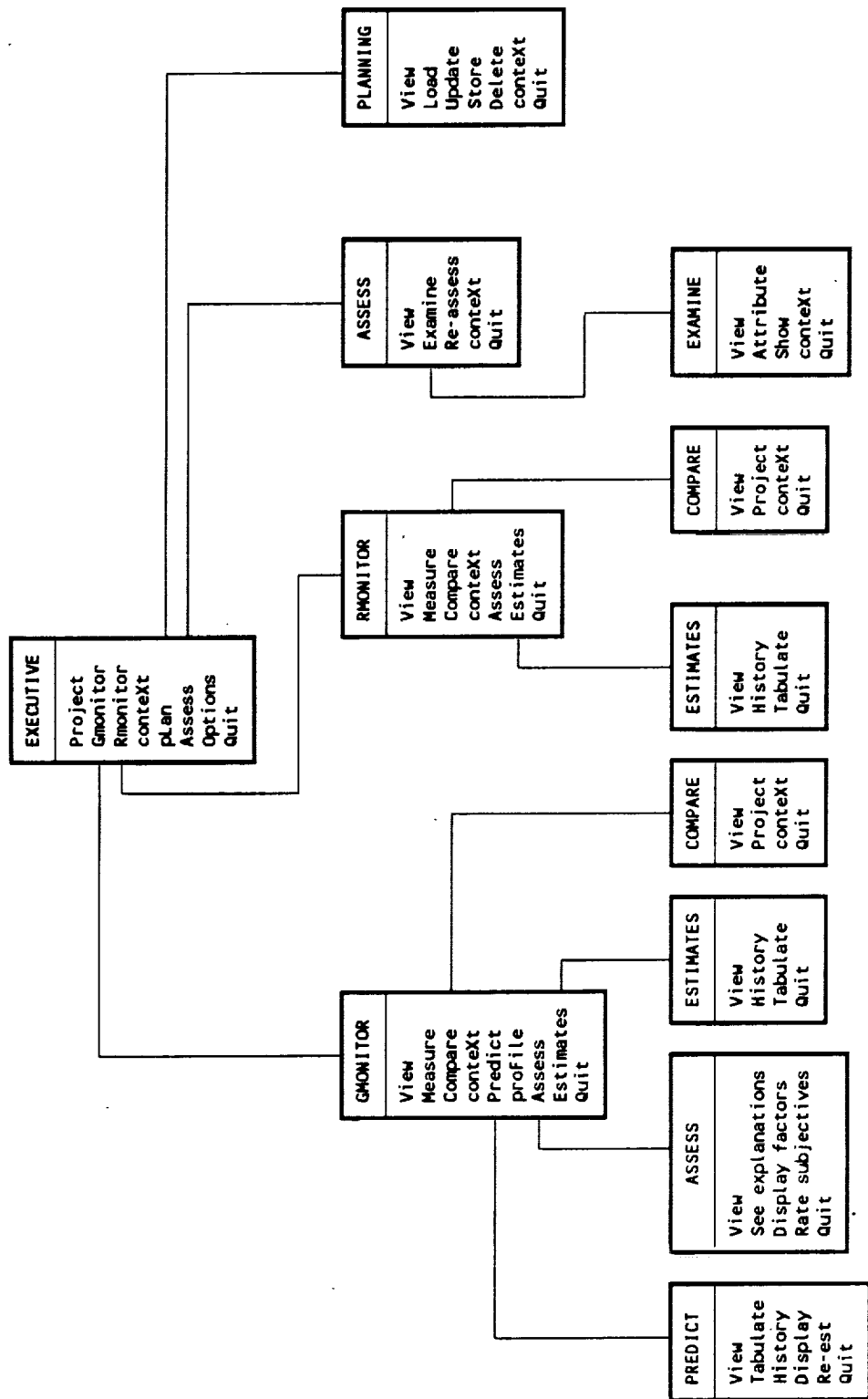
Figure 1-1. SME Menu Hierarchy

1.2 THE SME CONTEXT

Information describing a single project (termed "the project
of interest") is maintained in memory during an SME session.
This context holds user-specific information such as the
current project name, plan name, and performance measure
type. At the start of a session with the SME, the user's
most recent context is retrieved from a file in which the
context information from the previous SME session was saved.

A summary of the current context can be viewed by selecting
"context" from most menus. When a different project is
selected by the user to be the project of interest, the
context is updated with data for the new project. At the end
of a session with the SME, selected information from the
user's context (e.g., project name, measure type) is stored
in a file for subsequent retrieval at the start of the next
session.

1.3 SME DATA

There are five classes of data that need to be clearly
understood by users of the SME. These classes are

- Performance data
- Profile data
- Plans
- Models
- Phase estimates

Each class of data is briefly described in the following
sections.

1.3.1 PERFORMANCE DATA

Performance data is the time-history record of the growth of
an SME-defined performance measure. The data begins at zero
at the start of a project, and the cumulative value to date
is recorded at the sampling frequency. The data stops at the
end of a project for completed projects and at the most
recent sampling date for ongoing projects. Since the SEL
collects project data on a weekly basis, the SME uses a
weekly sampling frequency.

Eight measures of project performance are defined for use in
the SME. These performance measures are always identified
and referenced in the current release of the SME by the
three-character measure codes shown in Table 1-1.

Table 1-1. Performance Measure Codes

Performance Measure	Measure Code
Effort	EFF
Module count	MOD
Lines of code	LOC
Reported changes	RCH
Reported errors	RER
Module changes	MCH
Computer usage	CPU
Computer runs	RUN

Performance data for each of the SME measures is obtained on
a project-by-project basis from information in the SEL data
base. The performance data for a project map to the eight
SME measures as follows:

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1. EFF--Effort represents total staff hours
    expended by programmers and line management.
    The hours are obtained by summing all hours,
    regardless of activity, reported on SEL
    Personnel Resource Forms (PRFs) for a week.
    This definition excludes service hours and
    project management hours.

2. MOD--Module count is the number of members in
    the project's controlled source code library.
    The count is based on information reported on
    SEL Services/Products Forms (SPFs). This
    definition makes the value dependent on the
    composition of the controlled library. (Note:
    the module count is not derived from a count of
    SEL Component Origination Forms (COFs).)

3. LOC--Lines of code is the number of records in
    the project's controlled source code library.
    The count is based on information reported on
    SEL SPFs. As with the MOD measure, this value
    depends on the composition of the controlled
    library.

4. RCH--Reported changes reflects the number of
    logical changes to the system. This count is
    obtained by summing the number of SEL Change
    Report Forms (CRFs) submitted for a week.

5. RER--Reported errors reflects the number of
    logical changes to the system that are due to an
    error. This count is based on the number of SEL

CRFs submitted for a week on which the type of
change is listed as error correction.

6. MCH--Module changes is the number of versions of
    modules in the project's controlled source code
    library, minus the number of base versions.
    This count is based on information reported on
    SEL SPFs. (Note: this value is not derived from
    the count of modules changed as reported on SEL
    CRFs.)

7. CPU--Computer usage is the central processing
    unit (CPU) time used in hours by the project.
    These hours are based on information reported on
    SEL SPFs. The values from all computers used by
    a project are included in the total.

8. RUN--Computer runs is the number of jobs
    submitted by the project. This count is based
    on information reported on SEL SPFs. The job
    submission counts from all computers used by a
    project are included in the total.

1.3.2 PROFILE DATA

A sub-category of performance data is profile data, currently
collected in conjunction with reported changes (RCH) and
reported errors (RER). Collected on a weekly basis, this
information provides a distribution of effort expended as
provided on SEL CRFs by project developers.

Four profile types are defined for use in the current release of the SME, and are always identified and referenced by the four-character profile codes shown in Table 1-2.

Table 1-2. Profile Measure Codes

Profile Measure	Profile Code
Effort to Isolate Change	RCH1
Effort to Implement Change	RCH2
Effort to Isolate Error	RER1
Effort to Correct Error	RER2

The effort to isolate the change or error and the effort to implement the change or correction is categorized as requiring 1 hour or less, 1 hour to 1 day, 1 day to 3 days, more than 3 days, or unknown. The project-wide counts for each of these groupings are the basis for the information provided by the growth monitor "profile" option and the overall assessment function.

1.3.3 PLANS

In the SME, plans are composed of two elements: schedules and at-completion estimates.

The schedule used by the SME is derived from the set of phase dates supplied by the manager to the SEL on Project Estimates Forms (PEFs). The portion of the project life cycle used by the SME is limited to the period from the start of design through the end of acceptance testing.

The at-completion estimates used by the SME are based on the values supplied by the manager to the SEL on PEFs. The PEF-estimated values for delivered components, lines of delivered code, and effort are used to derive an estimate for each defined SME performance measure at project completion.

1.3.4 MODELS

Models of the software development process are derived from historical performance data and schedules from previous projects in the flight dynamics environment. Available models are based on either typical IBM FORTRAN attitude ground support systems (AGSSs) or Digital Equipment Corporation (DEC) Ada simulators, the two classes of systems regularly developed in the FDD environment. There is a data model for the expected cumulative growth of each defined measure.

1.3.5 PHASE ESTIMATES

Phase estimates (not to be confused with at-completion estimates) are created interactively by the manager during an SME session and recorded in an internal SME file for future reference. These estimates reflect the manager's estimate of the fraction of the project life cycle that has been completed on a specific date. The estimates are used in the prediction function of the growth monitor.

SECTION 2 - INSTALLING AND ACCESSING THE SME

This section presents detailed instructions for installing the SME communications program on a PC workstation and accessing the VAX-resident portion of the SME software. The following hardware and software items are required before the SME can be installed and used:

- IBM PC or compatible with an EGA color monitor

- Copy of the SME PC communications program

- VAX computer with the VAX portion of the SME software installed

- Modem or hard-wired connection to the VAX computer

- Valid VAX SME user identifier (e.g., SME_xxx) and password for logging on the STL computer

2.1 INSTALLING THE SME ON A PC

Insert the SME installation diskette into one of the PC disk drives. Change the default drive to reference the drive containing the diskette. For example, if the diskette is in the B drive, enter the following at the disk operating system (DOS) prompt:

2-1

```
C:\> b:
```

Before proceeding, the user must know two facts about the
particular PC on which the SME is being installed:

1. The number of the PC communications port
    attached to the VAX communications line
    (normally 1 or 2)

2. The baud rate of the communications line
    to the VAX (e.g., 4800, 9600)

The definitive source for this information is the PC system
coordinator for the user's organization. The SME PORTSTAT
utility, included on the installation diskette, may be used
to assist in determining the appropriate number to reference
the PC communications port. To run this utility, enter

```
B:\> portstat
```

For each PC communications port found, the utility outputs
one of the two following messages:

    comX: status is HHHH

    comX: is not present

In these messages, X will be the port's number (i.e., 1 or 2)
and HHHH will be the port's status displayed in hexadecimal.

If one communications port is reported as not present, the
user may assume the other port is attached to the VAX

communications line. Some PCs, however, have multiple
communications ports, and a status code will be reported for
each port. In this case, the user should consult the PC
system coordinator to determine the proper port to reference.

Once the port number and baud rate for the VAX communications
line are determined, the installation can be completed by
entering

        B:\> `install`

The INSTALL program executed by the command will prompt the
user for the port number and baud rate before installing the
needed SME PC software in the directory C:\SME on the hard
disk. If the SME directory does not exist, the program will
create it; if the directory already exists, any previously
installed versions of the SME communications software will be
overwritten.

As previously stated, executing the SME requires a VAX
computer with a copy of the VAX-resident portion of the SME
software. Detailed procedures governing the installation of
the SME VAX software can be found in the SME installation
guide (Reference 1).

2.2 ACCESSING THE SME FROM A PC

The method for accessing the SME from a PC consists of the
seven steps delineated as follows.

Step 1 - Establish a connection between the PC and the VAX

This activity varies depending on the hardware configuration
used by the PC to communicate with the VAX. If the PC is
hardwired to the VAX, this step may be ignored. For most
remote PCs connected by telephone, this step consists of
setting the baud rate for the telephone's data line and
dialing the appropriate number for the VAX.

Step 2 - Start the SME communications program on the PC

Set the default directory on the PC to the SME directory and
start the SME communications program by entering

```
C:\> cd \SME
C:\SME> smestart
```

A listing of the communications parameters in use will be
displayed followed by the message "Press return to connect".
In response, press the <Enter> key.

Step 3 - Log on to the VAX

As with Step 1, this activity varies based on the hardware
configuration used by the PC to communicate with the VAX.

Proceed through the various levels of communications hardware
and network messages, if any, until the VAX logon prompt is
displayed. At this point, enter the necessary VAX SME user
identifier and password as in the following example:

```
Username: SME_xxx
Password:
```

Step 4 - Set up to run the SME on the VAX

After successfully logging on to the VAX, enter the following
command to go to the directory in which the SME software
resides:

```
$ set def [sme]
```

Step 5 - Start the SME program on the VAX

Execute the SME by entering

```
$ @sme
```

There is an optional parameter, "expert", that can be entered
when issuing the above command. Because the SME requires a
LISP environment to enable the expert system feature (Section
6.6), this parameter assumes LISP is available on the VAX on
which the SME is to be run. To run in this environment,
enter the following:

```
$ @sme expert
```

After one of the above commands has been issued, the PC's
screen will clear and the SME program will start. (Refer to
Section 4 for the procedure to follow to enter the current
release of the SME. See Section 2.3 for directions on
temporarily returning to the DOS environment to execute
commands on the PC.)

Step 6 - Log off from the STL VAX

After terminating the SME program, log off from the VAX by
entering

    $ logoff

Subsequently, terminate the communications connection and, if
needed, hang up the data line on the telephone.

Step 7 - Terminate the SME communications program on the PC

Terminate the SME communications program and return to the
DOS environment on the PC by pressing the <Alt-X> key (i.e.,
hold down the Alt key and press the X key).

2.3 TEMPORARILY RETURNING TO DOS

A simple series of steps can be used to move back and forth
between the VAX session and DOS after running the SME on the
VAX computer.

To switch from the VAX session to the PC, follow these steps:

- If the SME software is running on the VAX,
  terminate the SME by selecting "Quit" at the
  executive menu (see Section 3.2).

- Return to DOS by pressing the <Alt-X> key (see
  Step 7 above).

At this point, the PC screen shows the DOS prompt. The user may perform local PC tasks under DOS while the VAX session is temporarily suspended.

To resume the VAX session, follow these steps:

- If necessary, return to the SME directory on the PC.

- Restart the SME PC communications program by entering "smestart" (see Step 2 above).

At this point, the user can obtain the VAX prompt by pressing the <Enter> key and may execute any VAX command or restart the SME (see Step 5 above).

2.4 RECOVERING FROM AN ABNORMAL TERMINATION

If the SME should somehow terminate abnormally, the user can return to the VAX "$" prompt by pressing the <Alt-X> key and then pressing the <Cntl-Y> key. At this point the user may execute any VAX command or restart the SME (see Step 4 above).

SECTION 3 - USING MENUS, LISTS, AND WINDOWS

The SME employs a variety of basic, system-wide display
mechanisms for interacting with the user in a consistent
manner. The primary mechanisms can be categorized as
selection menus, selection lists, display lists, and data
entry windows.

3.1 SELECTION MENUS

Selection menus are used to choose from options that control
the execution of SME functions. Options grouped on a given
menu correspond to a set of related features available at a
specific level within the functional hierarchy of the system.
Examples of selection menus in the SME include the executive
menu, the growth monitor menu, the rate monitor menu, and the
predict menu.

The options available on any SME menu are displayed in a
horizontal bar on the top row of the screen with one of the
options highlighted. A message that briefly explains the
function of the highlighted option appears on the following
row.

Pressing the <Enter> key selects the currently highlighted
option and initiates the execution of the corresponding SME
function. Pressing the <Esc> key returns to the next highest
menu in the hierarchy.

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Cursor control keys may be used to move the highlighting from
the current option to another desired option in the menu as
follows:

- The left arrow key moves the highlight to the left
  by one option, wrapping around to the last option as
  needed.

- The right arrow key moves the highlight to the right
  by one option, wrapping around to the first option
  as needed.

- The <Home> key moves the highlight to the first
  option in the menu.

- The <End> key moves the highlight to the last option
  in the menu.

An alternative method for selecting menu options involves the
use of hot keys. One character of each option in the menu is
capitalized and displayed in a different color. This letter
serves as the hot key for the option. Since this hot key
should uniquely identify its option, the key will not always
be the first character of the option. Pressing a hot key
character automatically selects the matching option and
initiates its execution.

3.2 SELECTION LISTS

Selection lists are used to display a list of items and
permit the user to choose one of the items from the list.
The list appears in a window with one item per row. A single

item in the list is highlighted as a default. Examples of
selection lists in the SME include the lists displayed for
choosing the current project of interest and the desired
measure for the project.

When the selection list is displayed, the item selected the
last time the list was displayed by the user will normally be
highlighted. For some uses, however, the first item in the
list will be highlighted.

Pressing the <Enter> key selects the currently highlighted
item and removes the selection list window from the screen.
Pressing the <Esc> key aborts the selection process and
removes the list from the screen.

If the selection list contains too many items to fit within
the window, the window will be filled with the maximum number
that can be displayed at one time. An indication will appear
at the bottom of the window to let the user know that more
items exist at the top and/or bottom of the list. When this
situation occurs, the user may scroll or page the items to
permit the entire list to be examined.

Cursor control keys may be used to move the highlighting from
the current item to another desired item in the list as
follows:

- The up arrow key moves the highlight up one item in
  the list, scrolling the items as needed.

- The down arrow key moves the highlight down one item
  in the list, scrolling the items as needed.

- The <Home> key moves the highlight to the first item in the list, paging to the top as needed.

- The <End> key moves the highlight to the last item in the list, paging to the bottom as needed.

- The <PgUp> key displays the previous page of the list, leaving the highlight at the same relative location within the window.

- The <PgDn> key displays the next page of the list, leaving the highlight at the same relative location within the window.

The highlight can also be moved to a particular item in a selection list by typing the first letter of the item. In cases where multiple entries in the selection list start with the same letter, the highlight moves downward to the next entry that starts with the entered letter.

A bell sounds when an attempt is made to scroll or page beyond the top or bottom of the selection list.

3.3 DISPLAY LISTS

Display lists are used to display a list of items and permit the user to browse the items in the list. As with selection lists, the list appears in a window with one item per row. Unlike selection lists, however, no mechanism exists for highlighting or selecting an item.

The items on each row often appear as a record of several
related fields with column headers displayed over the fields.
An example of one such display list in the SME is the table
of phase estimates and past predictions displayed when the
tabulate option is selected from the predict menu.

If the list cannot be displayed in its entirety within the
window, full support is provided for scrolling and paging via
the up arrow, down arrow, <Home>, <End>, <PgUp>, and <PgDn>
keys. If the list can be displayed in its entirety, these
keys have no effect.

Pressing the <Enter> or <Esc> key removes the display list
window from the screen.

3.4 DATA ENTRY WINDOWS

Data entry windows are used by the SME to obtain numeric or
character data from the user. One example of a data entry
window in the SME occurs with the input of new phase
estimates when the re-estimate option is selected from the
predict menu (Section 5.4.6).

When the window is displayed, a column of data entry fields
optionally filled with default values appears in the window.
Each data entry field is labeled with a name or description
identifying the item to be entered. The field for one of the
items is highlighted.

Entry of an input value into a particular data entry field
may be accomplished only when that field is highlighted.

NOTICE
This is DRAFT documentation containing information not
yet considered final and complete.

Cursor control keys may be used to move the highlighting from the current field to another desired field as follows:

- The up arrow key moves the highlight up one field, wrapping to the field at the bottom of the screen as needed.

- The down arrow key moves the highlight down one field, wrapping to the field at the top of the screen as needed.

Once the desired field is highlighted, the user may begin entering the new value. As the first key is pressed, the original field value is erased and the user's keystrokes are echoed into the field. A highlighted cursor character is employed to indicate the location within the field for the next character entered. A bell sounds when any attempt is made to (1) enter more characters than the field will hold or (2) backspace while at the beginning of the field.

When data entry for the highlighted field is complete, the up and down arrow keys may be used to position to the next field. The entered value is validated at this point. If a problem is encountered, the field in error remains highlighted, and a message appears at the bottom of the data entry window explaining the error.

The user may abort the entry of a field at any time and restore the field's original value by pressing the <Home> key.

After all desired fields have been entered, the user should
press the <Enter> key to save the new information. This
causes the fields to be validated and a confirmation message
to be issued before the data entry operation is terminated.

Pressing the <Esc> key at any time will abort the data entry
operation and leave the data values unchanged.

SECTION 4 - SME EXECUTIVE FUNCTIONS

4.1 INITIALIZATION

Upon starting the SME on the VAX, an initial informational
screen appears on the PC to identify the software and display
which SME release is being used. A message at the bottom of
the display instructs the user to "press return to continue."

After return has been pressed, the SME generates a second
screen informing the user that the SME session is being
initialized. At this point the SME is retrieving context
information (Section 1.2) about the user's previous SME
session, if available. First-time users receive valid
default context values, and a message to this effect is
generated.

After initialization for the user completes, the executive
menu is displayed at the top of the screen. The menu
contains eight options for selection: project, growth
monitor, rate monitor, context, plan, assess, options, and
quit. Initially, the project option is highlighted as a
default. Figure 4-1 presents the executive menu. Section
3.1 presents detailed information on choosing options from a
selection menu.

Project	Gmonitor	Rmonitor	conteXt	pLan	Assess	Options	Quit
Select a different project.							

Figure 4-1. Executive Menu

The SME consists of an executive structure and several major
functions accessed from the executive level menu. The
project, growth monitor, rate monitor, context, plan, assess,
options, and quit functions are described below. Figure 4-2
shows a summary of the SME executive menu functions.

4.2 PROJECT

The project option permits the user to change the current
project of interest. A pop-up window appears containing a
selection list of all available projects. On the selection
of a new project, the screen will be cleared of any
previously drawn plot. Section 3.2 presents detailed
information on choosing items from a selection list.

4.3 GROWTH MONITOR

The growth monitor option causes the growth monitor function
to be executed for the current project of interest. The
growth monitor is used to view and analyze a project's
performance by plotting performance data for a selected
measure (e.g., lines of code). Section 5 presents details of
the growth monitor functions.

4.4 RATE MONITOR

The rate monitor option causes the rate monitor function to
be executed for the current project of interest. The rate
monitor is used to view and analyze a project's performance
by plotting the cumulative ratio of two selected measures
(e.g., reported errors/lines of code). Section 6 presents
details of the rate monitor functions.

```
                --- SME EXECUTIVE MENU ---

Project      Select a different project.
Gmonitor     Monitor performance of a project using growth measures.
Rmonitor     Monitor performance of a project using rate measures.
conteXt      Display summary of current context.
pLan         Create a new plan (re-estimate).
Assess       Judge the health of the current project.
Options      Set display options for guidelines and plan, or set project date.
Quit         Save current environment and terminate SME.
```

Figure 4-2.   SME Executive Menu Summary

4.5 CONTEXT

The context option displays a pop-up window containing a summary of the current context. At the executive menu this information consists of the current project of interest, the current plan name, and the manager's at-completion estimates for each performance measure. Normal estimates and actual current data values for each performance measure are also displayed, along with schedule information. Pressing the <Enter> or <Esc> key removes the context display.

4.6 PLAN

The plan option causes the planning function to be executed for the current project of interest. The planning function is used to create alternative project plans by enabling the user to modify schedules and estimates interactively. The planning function can also be used to load previously created alternative plans. Section 7 presents details of the planning functions.

4.7 ASSESS

The assess option causes the overall assessment function to be executed for the current project of interest. Overall assessment is used to view a project's general health by analyzing and displaying project attributes (e.g., reliability, maintainability). Section 8 presents details of the overall assessment functions.

4.8 OPTIONS

The options selection enables the user to modify certain SME
display parameters. The user can govern whether the SME
displays the measure guidelines and/or a model of the
manager's planned growth. The user can also set a project
date, which governs which baseline plan the SME uses for
plotting and truncates performance data to emulate the state
of the project on that date. Section 9 presents details on
these functions.

4.9 QUIT

The quit option ends the SME session. If any modifications
to the project plan have been made and the plan has not been
stored, a message is displayed asking if the user wants to
store the plan. If the user replies yes, the user is put in
the planning function store option (Section 7.2.4). If the
user answers no, a message is displayed asking for
confirmation before proceeding with the termination process.
If no plan modifications have been made, the termination
confirmation is displayed directly.

SECTION 5 - GROWTH MONITOR FUNCTIONS

The growth monitor is used to view and analyze a project's
performance by plotting performance data for a selected measure
(e.g., lines of code). The following sections detail the use of
the growth monitor functions.

5.1 GENERAL INFORMATION

On entry into the growth monitor function, two actions occur
before the growth monitor menu appears.

First, a pop-up window appears containing a selection list of all
available measures for the current project of interest. The
current measure, set from information in the context, is
highlighted and may be changed by selecting a new measure from
the list. Section 3.2 presents detailed information on choosing
items from a selection list.

Second, the SME generates a plot of the performance data for the
selected measure of the current project of interest. Figure 5-1
shows a sample plot. Table 5-1 explains the phase codes at the
top of Figure 5-1.

Table 5-1. Phase Name Codes

Coded Name	Life-cycle Phase
DESGN	Design
CODET	Code and test
SYSTE	System test
ACCTE	Acceptance test

```
       02              09              03   11         06 Mgr's
       10              29              24   16         06 Plan
       90              90              91   91         92 Sch
```
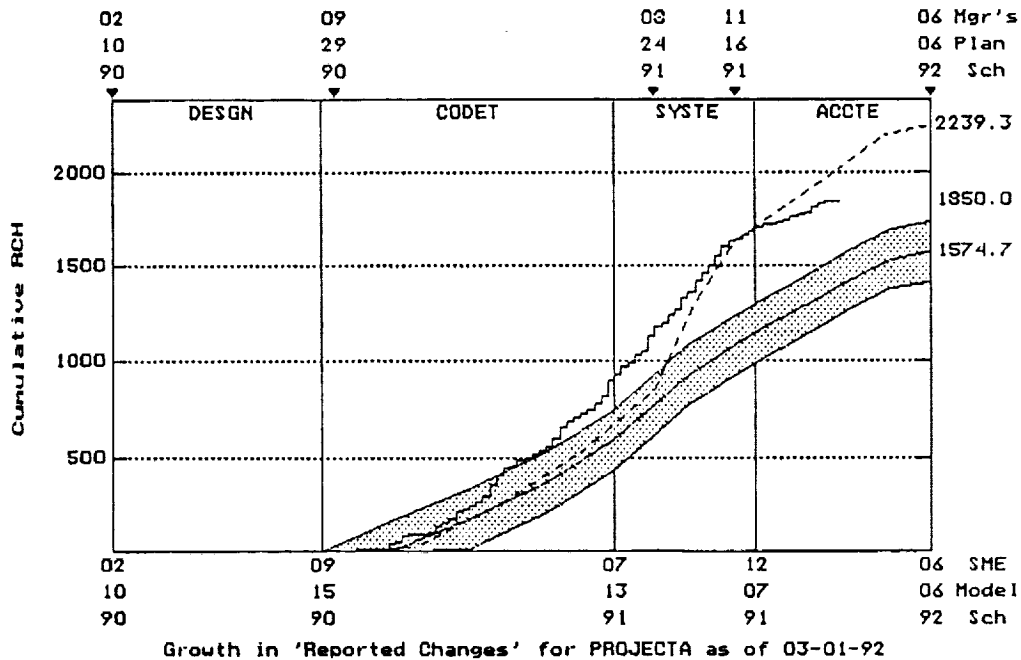
Figure 5-1.   Sample Growth Monitor Plot

The growth monitor plot has the following features:

●   The measure type, project name, and project date
     appear in the plot title.

●   The SME schedule template for the four lifecycle
     phases is displayed across the bottom edge of the
     plot; the manager's schedule is displayed across
     the top edge of the plot, along with the phase
     names.

●   Optional guidelines (Section 9.2) representing a
     model of a typical project are shown as a blue-
     shaded region with the nominal, minimum, and
     maximum expected growth curves for the measure

highlighted in light blue. The guidelines are
labeled on the right edge of the plot in blue with
a value the SME considers normal for the measure
for a project of this magnitude.

- The manager's projected growth for the measure is
  optionally displayed (Section 9.3) on the plot as
  a dashed yellow line, and labeled on the right
  edge with the manager's estimated completion value
  for the measure.

- The project's performance data for the current
  measure is shown as a green line that conforms to
  the step-wise, weekly growth of the measure, and
  is labeled on the right side of the plot with the
  current actual value for the measure.

- Dotted lines appear horizontally on the plot at
  regular intervals to indicate the plot scale and
  are labeled along the left edge of the plot.

After <Enter> or <Esc> is pressed, the growth monitor menu
appears at the top of the screen. The menu contains nine options
for selection: view, measure, compare, context, predict,
profile, assess, estimates, and quit. Initially, the view option
is highlighted as a default. Figure 5-2 presents the growth
monitor menu.

```
┌──────────────────────────────────────────────────────────────────┐
│ View  Measure  Compare  conteXt  Predict  proFile  Assess  Estimates  Quit │
├──────────────────────────────────────────────────────────────────┤
│ Remove everything covering graph.                                  │
└──────────────────────────────────────────────────────────────────┘
```
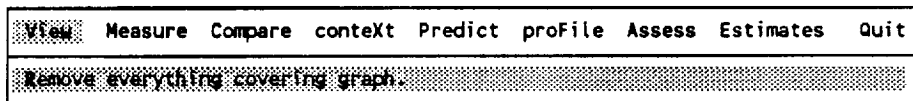
Figure 5-2. Growth Monitor Menu

5.2   GROWTH MONITOR MENU OPTIONS

The following sections describe the view, measure, compare,
context, predict, profile, assess, estimates, and quit options.

5.2.1 VIEW

The view option temporarily removes the growth monitor menu from
the screen to uncover the entire plotting area. Once the plot is
uncovered, pressing any key restores the menu.

5.2.2 MEASURE

The measure option permits the user to change the current growth
measure. A pop-up window appears containing a selection list of
all available measures for the current project of interest. Any
measure on the list may be selected. Section 3.2 presents
detailed information on choosing items from a selection list.

If the user selects a new measure, the current plot is erased and
replaced with a new plot of the selected measure. Pressing ·
<Enter> or <Esc> will restore the growth monitor menu.

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5.2.3 COMPARE

The compare option causes the growth monitor compare function to
be executed. The compare function is discussed in detail in
Section 5.3.

5.2.4 CONTEXT

The context option of the growth monitor menu displays a window
that presents information summarizing the current measure and
schedule. The display presents schedule information about the
project of interest, including the current date (or completion
date for a finished project) and estimated completion date, the
project's schedule duration expressed in number of weeks, the
number of weeks of the schedule that have elapsed to date, and
the current week number and total number of weeks expressed as
percentages of the total schedule duration. The display also
contains information relevant to the current growth measure, such
as the measure value, the value expected on this date (with
respect to the guidelines), and the manager's estimate at
completion. The values are also displayed as percentages of the
manager's at-completion estimate. Pressing <Enter> or <Esc>
returns the user to the growth monitor menu.

5.2.5 PREDICT

The predict option causes the growth monitor prediction function
to be executed. This is discussed in detail in Section 5.4.

5.2.6 PROFILE

The profile option of the growth monitor permits the user to view profile information for the currently selected growth measure. A profile is a decomposition of a measure into elemental components. For example, the total number of reported errors for a project can be broken down into number of errors that took less than 1 hour to isolate, the number of errors that took between 1 and 3 hours to isolate, and so forth. If profile data is available, a pop-up window appears containing a selection list of the available profile types. The user can select the desired type using the selection methods described in Section 3.2.

Upon selecting a profile type, a window containing a horizontal bar graph is generated. Each of the components for the selected profile is represented by a pair of bars on the graph. The upper bar (in green) represents the actual reported number of cases for that component to date. The lower bar (in light blue) represents the estimated number of cases at project completion for the component based on a model of that profile type. A red line appears on the lower bar to indicate the expected number of cases for the component to date. The actual data values are displayed next to their corresponding graph bars. Pressing the <Enter> or <Esc> key removes the bar graph window and restores the previously existing growth measure plot.

5.2.7 ASSESS

The assess option causes the growth monitor assessment function to be executed. This is discussed in detail in Section 5.5.

5.2.8 ESTIMATES

The estimates option causes the estimate function to be executed. This is discussed in detail in Section 5.6.

5.2.9 QUIT

The quit option removes the growth monitor menu and returns the user to the executive menu.

5.3 GROWTH MONITOR COMPARE FUNCTION

The growth comparison function plots performance data from other projects for the current measure. The points plotted are normalized to the duration and completion value of the original project and added to the current plot. The following sections detail the use of the growth comparison function.

5.3.1 GENERAL INFORMATION

On entry into the growth comparison function, the growth comparison menu is displayed at the top of the screen. The growth comparison menu contains four options for selection: view, project, conteXt, and quit. Initially, the project option is highlighted as a default. Figure 5-3 presents the growth comparison menu.

View	Project conteXt	Quit
Plot a comparison project.		
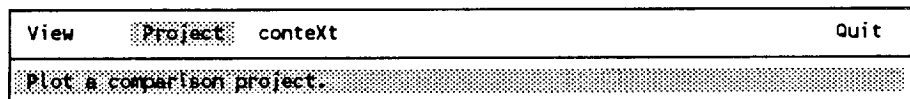
Figure 5-3. Growth Comparison Menu

The view, project, context, and quit selections are described
below.

5.3.2 VIEW

The view option temporarily removes the growth comparison menu
from the screen to uncover the entire plotting area. Once the
plot is uncovered, pressing any key restores the menu.

5.3.3 PROJECT

The project option permits the user to select a project for
comparison with the current project. A pop-up window appears
containing a selection list of all projects that have data for
the current measure. Any project on the list may be selected.
Section 3.2 presents detailed information on choosing items from
a selection list.

If the user selects a comparison project, the growth comparison
menu is removed, the current plot is redrawn, and the performance
data for the selected project (and each subsequent comparison
project) is added to the plot. Figure 5-4 presents a sample
growth comparison plot.

02	09	08	11	06 Mgr's
10	29	24	16	06 Plan
90	90	91	91	92 Sch

Growth in 'Reported Changes' for PROJECTA as of 03-01-92
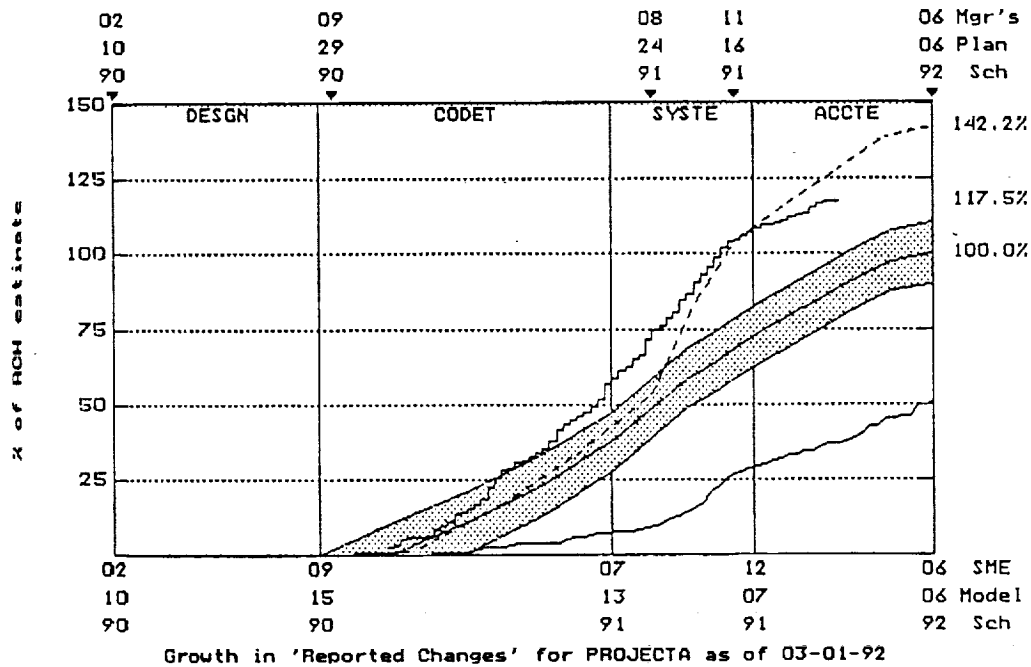
Figure 5-4. Sample Growth Comparison Plot

The growth comparison plot has the following features:

- The measure type, project name, and project date appear in the plot title.

- The SME schedule template for the four life cycle phases is displayed across the bottom edge of the plot; the manager's schedule is displayed across the top edge of the plot, along with the phase names.

- Optional guidelines (Section 9.2) representing a model of a typical project are shown as a blue-shaded region with the nominal, minimum, and maximum expected growth curves for the measure

highlighted in light blue. These guidelines are
labeled on the right edge of the plot in blue as
100 percent of what the SME considers normal for
the measure for a project of this magnitude.

- The manager's projected growth for the measure is
  optionally displayed (Section 9.3) on the plot as
  a dashed yellow line, and labeled on the right
  edge with the manager's estimated completion value
  for the measure represented as a percentage of the
  guideline, or normal value.

- The project's performance data for the current
  measure is shown as a green line that conforms to
  the step-wise, weekly growth of the measure, and
  labeled on the right side of the plot with the
  current actual value for the measure represented
  as a percentage of the guideline value.

- The performance data for the comparison project is
  shown on the plot as a solid line drawn to that
  project's actual value with respect to its own
  normal value for the measure.

- Dotted lines appear horizontally on the plot at
  regular intervals (typically every 25 percent) to
  indicate the plot scale and are labeled along the
  left edge of the plot.

5.3.4 CONTEXT

The context option displays a pop-up window containing a legend
of all comparison projects that have been plotted, including the
project name and color and pattern used to display the projects
on the comparison plot. Pressing the <Enter> or <Esc> key
removes the context display.

5.3.5 QUIT

The quit option removes the growth comparison menu and returns
the user to the growth monitor menu.

5.4 GROWTH MONITOR PREDICT FUNCTION

The predict function allows the user to predict the future growth
expected for the current performance measure. The following
sections detail the use of the predict function.

5.4.1 GENERAL INFORMATION

The predict function of the growth monitor causes four pop-up
windows to appear, three for display and one for selection. The
three windows that appear across the top of the screen describe
the methods available to the user for calculating a prediction,
and the bottom window enables the user to select one of these
methods.

The upper-left window displays information that will be used to
calculate the prediction if the user chooses to base the
prediction on SME data. If selected, the SME will take an
average of all performance data available for the project of

interest in order to arrive at a schedule, and then calculate a
prediction for the growth of the current measure based on that
schedule.

The upper-middle window enables the user to view information that
was used to calculate the last prediction.

The upper-right window presents information that will be used if
the last completed SEL data base phase is selected as the basis
for prediction.

The bottom window allows the user to select one of the options
displayed as the basis for predicting the growth of a measure.
The window also enables the user to create a phase estimate as
the basis for prediction by selecting the edit option. Each
phase estimate supplied by the user consists of three values as
follows:

- Date--A date corresponding to a Friday in the
  format MM-DD-YY specifying the point in the project
  schedule on which the estimate is to be applied

- Phase name--A coded name for a life-cycle phase
  indicating the user's estimation of the project's
  phase on the above date

- Percentage complete--A value indicating the user's
  estimation of the fraction of the project's phase
  that is complete on the above date

Refer to table 5-1 for valid phase name values for a user's
estimate.

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The user inputs values for the estimate's date, phase name, and percentage complete in a data entry window that appears on the screen. Section 3.4 presents details on data entry window operations.

Each input value entered by the user is validated as follows:

- Date--Must be a valid date in the format MM-DD-YY that is between the start of design and the date of the most recent performance data (note that the date will be changed automatically to the Friday of the week in which the date falls)

- Phase name--Must be selected from the list of valid phase name codes defined in Table 5-1

- Percentage complete--Must be an integer in the inclusive range 0 to 100

Once a basis exists for the prediction, the SME generates a plot of the performance data for the current measure and displays the predicted growth of the measure from the estimate date to the end of the project. Figure 5-5 shows a sample of such a plot.

```
        02              09              08   11          06 Mgr's
        10              29              24   16          06 Plan
        90              90              91   91          92  Sch
         ▼               ▼               ▼    ▼           ▼
```

Predicted Growth in 'Reported Changes' for PROJECTA as of 03-01-92
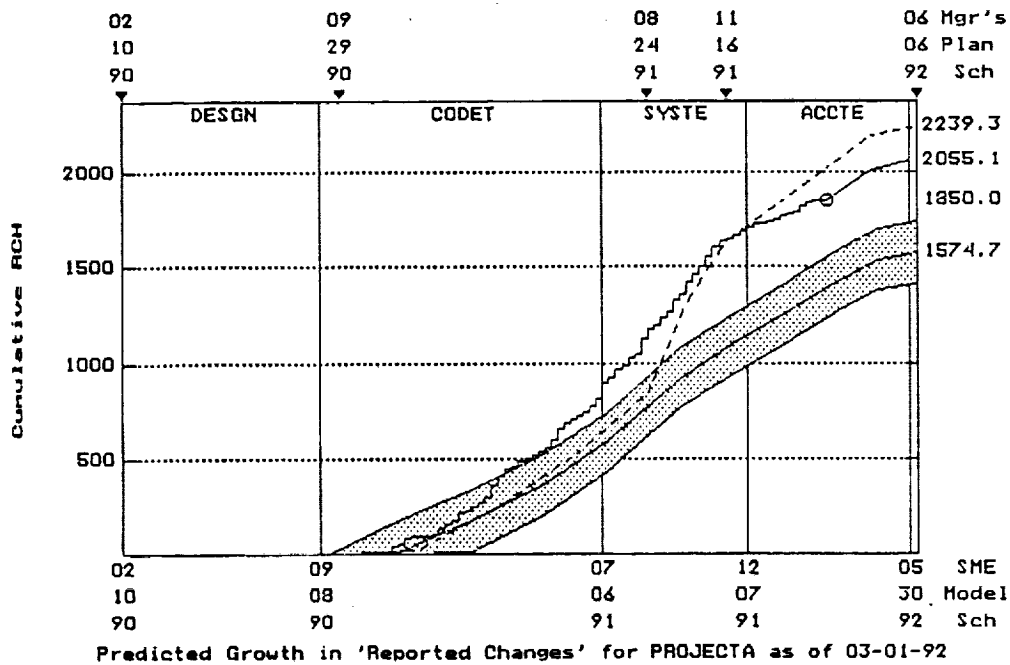
Figure 5-5.   Sample Prediction Plot

The prediction plot has the following features:

● The project name, performance measure, and project
date are contained in the plot title.   The
performance measure also appears to the left of
the Y-axis on the plot.

● The SME schedule template for the four life-cycle
phases is displayed across the bottom edge of the
plot.   This schedule may vary depending on what
method was used to calculate the prediction.

● The manager's schedule is displayed across the top
of the plot, along with the phase names.

- Optional guidelines (Section 9.2) representing a model of a typical project are shown as a blue-shaded region with the nominal, minimum, and maximum expected growth curves for the measure highlighted in light blue.

- The manager's projected growth for the measure is optionally displayed (Section 9.3) on the plot as a dashed yellow line.

- The project's performance data for the current measure is shown as a green line that conforms to the step-wise, weekly growth of the measure.

- The predicted growth of the measure is plotted from the date used as a basis for the prediction to the predicted end of the project as a red curve.

- The predicted at-completion value, the SME guideline value, the manager's estimated at-completion value, and the most recent value for the measure appear to the right of the plot in red, light blue, yellow, and green, respectively.

After <Enter> or <Esc> is pressed, the predict menu appears at the top of the screen. The predict menu contains six options for selection: view, tabulate, history, display, re-estimate, and quit. Initially, the tabulate option is highlighted as a default. Figure 5-6 presents the predict menu.

```
View        Tabulate   History   Display   Re-est                     Quit

Display list of historical predictions.
```

Figure 5-6.   Predict Menu

The view, tabulate, history, display, re-estimate, and quit
selections are described below.

5.4.2   VIEW

The view option temporarily removes the predict menu from the
screen to uncover the entire plotting area.   Once the plot is
uncovered, pressing any key restores the menu.

5.4.3   TABULATE

The tabulate option displays a pop-up window containing a list of
all phase estimates made by the user for the project to date.
For each entry in the list, the estimated values for date, phase
name, and percentage complete are displayed with the
corresponding predictions of the project completion date and the
at-completion value of the measure.   If the list of phase
estimates cannot be displayed entirely within the window, the
list may be scrolled or paged as described in Section 3.3.
Pressing the <Enter> or <Esc> key removes the list and restores
the predict menu.

5.4.4   HISTORY

The history option plots the results of predictions based on all
previous phase estimates made by the user to date.   The predict

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menu is removed, and the predicted at-completion value for each estimate is plotted as a function of the date on which the estimate was based. These values are displayed directly on the prediction plot and show the trend in the predicted completion values with time. Pressing any key restores the predict menu.

5.4.5 DISPLAY

The display option causes three windows to appear on the screen containing additional information that summarizes the most recent prediction as follows:

- The upper-left window displays the phase estimate that served as the basis for the prediction. The value of the performance measure for the date on which the estimate was based is also shown.

- The upper-right window compares the prediction completion value with the manager's at-completion estimate from the SEL data base.

- The bottom window summarizes the prediction at each phase transition. The manager's estimated phase end date, the predicted phase end date, and the predicted measure value at phase end are listed.

Pressing the <Enter> or <Esc> key removes the windows and returns to the predict menu.

5.4.6 RE-ESTIMATE

The re-estimate option causes a return to the four initial pop-up
windows, which allows the user to change the basis for prediction
if desired.

5.4.7 QUIT

The quit option removes the predict menu and returns the user to
the growth monitor menu.

5.5 GROWTH MONITOR ASSESS FUNCTION

The assess function allows the user to view possible or known
explanations for a project's deviation from an expected range.
The following sections detail the use of the assess function.

5.5.1 GENERAL INFORMATION

The assess option of the growth monitor causes a pop-up window to
appear containing information relevant to the project's
performance for the current measure with respect to the
guidelines. If no deviation is found, an informational message
to that effect is displayed. Pressing any key returns the user
to the growth monitor menu.

If a deviation is found, the pop-up window will contain known or
possible explanations for the deviation. Pressing the <Esc> key
at this point will return the user to the growth monitor menu.
Pressing the <Enter> key causes the trend assessment menu to be
displayed. The trend assessment menu has five options for
selection: view, see explanations, display factors, rate

subjectives, and quit. Initially, the see explanations option is
highlighted as a default. Figure 5-7 presents the assess menu.

View	See explanations	Display factors	Rate subjectives	Quit
Display all explanations related to the deviation for the measure				
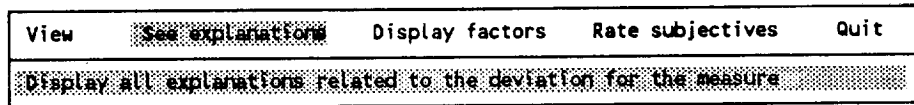
Figure 5-7. Assess Menu

The view, see explanations, display factors, rate subjectives,
and quit selections are described below.

5.5.2 VIEW

The view option temporarily removes the trend assessment menu
from the screen to uncover the entire plotting area. Once the
plot is uncovered, pressing any key restores the menu.

5.5.3 SEE EXPLANATIONS

Choosing the see explanations feature of the trend assessment
menu causes a pop-up window to be generated containing all
potential explanations related to the deviation in the current
measure. The maximum and actual relative rank displayed for each
explanation in the list indicate the importance and probability
of the reason in explaining the deviation. A positive ranking
indicates that the reason is likely; a zero ranking indicates
that the reason is possible; a negative ranking indicates that
the reason is not probable. Pressing <Enter> or <Esc> returns
the user to the trend assessment menu.

5.5.4 DISPLAY FACTORS

This option of the trend assessment menu enables the user to
display all the factors affecting the explanations for the
deviation. The factor name is displayed, along with the factor
type (subjective, objective, or dependent), the rating (unknown,
low, normal, or high), and the certainty of the current rating.
If the entire list of factors cannot be displayed entirely within
the window, the list may be scrolled or paged as described in
Section 3.3. Pressing the <Enter> or <Esc> key removes the list
and restores the trend assessment menu.

5.5.5 RATE SUBJECTIVES

This option of the trend assessment menu enables the user to view
or modify the current ratings of subjective factors affecting the
explanations for the deviation. A pop-up window appears
containing possible subjective factors, with the first factor
highlighted. The user may select any factor that appears in the
window to view or change. Upon making a selection, a second pop-
up window appears containing the factor selected and its current
rating. At this point the user may change the rating by
selecting unknown, low, normal, or high and pressing <Enter>, or
may return to the trend assessment menu by pressing the <Esc>
key.

5.5.6 QUIT

The quit option removes the trend assessment menu and returns the
user to the growth monitor menu.

5.6 GROWTH MONITOR ESTIMATES FUNCTION

The estimates function allows the user to view all the estimates
that were made by the manager to date for the current measure.
The following sections detail the use of the estimates function.

5.6.1 GENERAL INFORMATION

On entry into the estimates function, the estimates menu is
displayed at the top of the screen. The estimates menu contains
four options for selection: view, history, tabulate, and quit.
Initially, the view option is highlighted as a default. Figure
5-8 presents the estimates menu.

```
 View    History  Tabulate                                    Quit

 Remove everything covering graph.
```
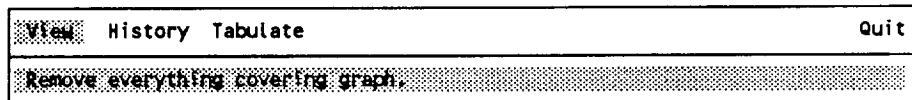
Figure 5-8. Estimates Menu

The view, history, tabulate, and quit selections are described
below.

5.6.2 VIEW

The view option temporarily removes the estimates menu from the
screen to uncover the entire plotting area. Once the plot is
uncovered, pressing any key restores the menu.

5.6.3 History

The history option plots all the manager's estimates made to date
for the current measure. The estimates menu is removed, and the
estimated at-completion values for the measure are plotted as a
function of the date on which each estimate was made. These
values are displayed directly on the growth monitor plot and show
the trends in the estimated completion values over time.
Pressing <Enter> or <Esc> restores the estimates menu.

5.6.4 Tabulate

The tabulate option displays a pop-up window containing a list of
all estimates made for the measure to date. All estimated
completion values and corresponding dates made are displayed. If
the list of estimates cannot be displayed entirely within the
window, the list may be scrolled or paged as described in Section
3.3. Pressing the <Enter> or <Esc> key removes the list and
restores the estimates menu.

5.6.5 Quit

The quit option removes the estimates menu and returns the user
to the growth monitor menu.

SECTION 6 - RATE MONITOR FUNCTIONS

The rate monitor is used to view and analyze a project's
performance by plotting the cumulative ratio of two selected
measures (e.g., reported errors/lines of code). The
following sections detail the use of the rate monitor
functions.

6.1 GENERAL INFORMATION

When the rate monitor function is selected from the SME
executive menu, a pop-up window appears containing a
selection list (Section 3.2) of all available measures for
the project of interest. The current rate measure, initially
set from information in the context, appears at the top of
the window. This rate measure consists of a pair of measures
that serve as the numerator and denominator of the ratio to
monitor. To change the current rate measure, the user first
selects the measure to be used as the numerator from the
list. A second selection list of the remaining available
measures will then appear for choosing the denominator. Once
the selection is made, the SME generates a plot of the
cumulative ratio of the performance data for the two measures
selected. Figure 6-1 shows a sample plot.
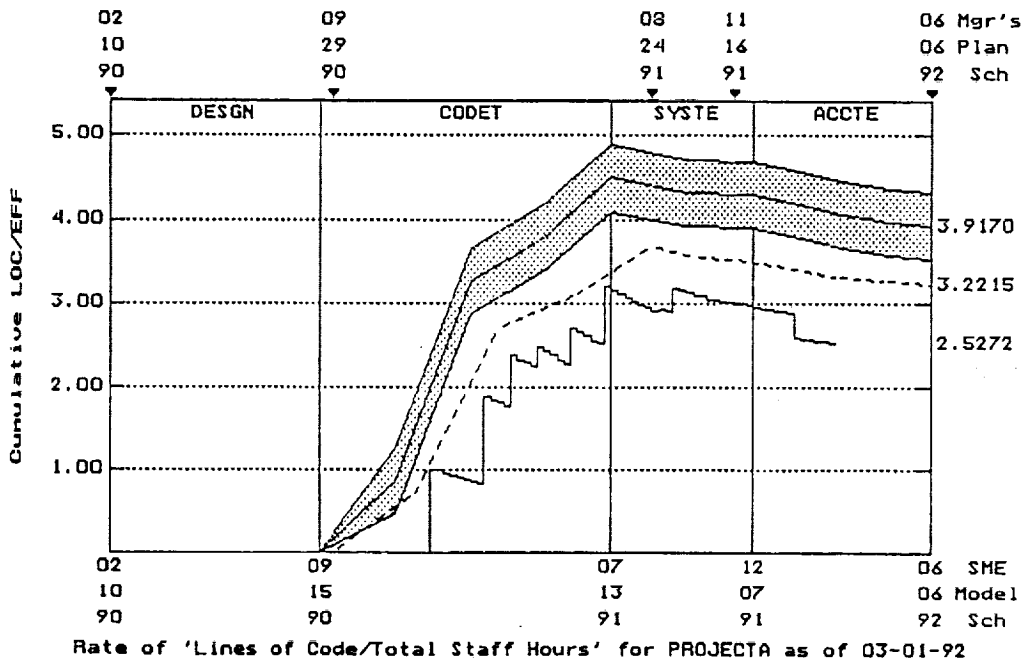
Figure 6-1. Sample Rate Monitor Plot

The rate monitor plot has the following features:

- The ratio type, project name, and project date appear in the plot title.

- The SME schedule template for the four lifecycle phases is displayed across the bottom edge of the plot; the manager's schedule is displayed across the top edge of the plot, along with the phase names.

- Optional guidelines (Section 9.2) representing a model of a typical project are shown as a blue-shaded region with the nominal, minimum, and maximum expected growth curves for the ratio of the measures highlighted in light blue. The guidelines

6-2

are labeled in on the right edge of the plot in
blue with what the SME considers normal for the
rate for a project of this type.

- The ratio of the manager's projected growth for the
  two measures is optionally displayed (Section 9.3)
  on the plot as a dashed yellow line, labeled in
  yellow at the right edge of the plot with the ratio
  of the manager's completion estimates.

- The project's performance data for the ratio of the
  two measures is shown as a green line that conforms
  to the step-wise, weekly growth of the cumulative
  ratio.

- The most recent value for the ratio of the measures
  appears in green at the plot's rightmost edge to
  indicate the actual magnitude of the ratio attained
  to date.

- Dotted lines appear horizontally on the plot at
  regular intervals to show the plot scale and are
  labeled along the left edge of the plot.

After pressing <Enter> or <Esc>, the rate monitor menu
appears at the top of the screen. The rate monitor menu
contains seven options for selection: view, measure,
compare, context, assess, estimates, and quit. Initially,
the view option is highlighted as a default. Figure 6-2
presents the rate monitor menu.

```
┌─────────────────────────────────────────────────────────────┐
│ :::View::   Measure   Compare   conteXt   Assess   Estimates        Quit  │
├─────────────────────────────────────────────────────────────┤
│ Remove everything covering graph.                                         │
└─────────────────────────────────────────────────────────────┘
```

Figure 6-2.   Rate Monitor Menu

6.2   RATE MONITOR MENU OPTIONS

The following sections describe the view, measure, compare, context, assess, estimates, and quit options.

6.2.1   VIEW

The view option temporarily removes the rate monitor menu from the screen to uncover the entire plotting area. Once the plot is uncovered, pressing any key restores the menu.

6.2.2   MEASURE

The measure option permits the user to change the pair of measures the rate monitor will use as the numerator and denominator for the cumulative ratio. Selecting the option causes a pop-up window to appear containing a list of all available measures for the current project of interest. After the measure to be used as the numerator is selected from the initial list, a second selection list of the remaining available measures appears in the window to permit the selection of a measure to be used as the denominator. Section 3.2 presents detailed information on choosing items from a selection list.

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If the user changes one or both of the measures, the current plot is erased and replaced with a plot of the cumulative ratio for the newly selected rate measure. Pressing <Enter> or <Esc> will restore the rate monitor menu.

6.2.3 COMPARE

The compare option of the rate monitor menu causes the rate comparison function to be executed. This is discussed in detail in Section 6.3.

6.2.4 CONTEXT

Like the context option of the growth monitor (Section 5.2.4), the context option of the rate monitor menu displays a window that presents information summarizing the current measure and schedule, except in this case the measure is actually a ratio of two measures. The display presents schedule information about the project of interest, including the current date (or completion date for a finished project) and estimated completion date, the project's schedule duration expressed in number of weeks, the number of weeks of the schedule that have elapsed to date, and the current week number and total number of weeks expressed as percentages of the total schedule duration. The display also contains information relevant to the current ratio of measures, such as the ratio value, the value expected on this date (with respect to the guidelines), and the ratio of the manager's estimates for the measures at completion. The values are also displayed as percentages of the completion estimate. Pressing <Enter> or <Esc> returns the user to the rate monitor menu.

6.2.5 ASSESS

Use of the assess option requires that the SME be running in
expert mode, thereby providing access to the SME LISP-based
expert system (Section 2.2). By interpreting specific
project measure ratios, the expert system generates an
analysis of general project trends that deviate from model
guidelines. When the user chooses the assess option of the
rate monitor menu, a pop-up window appears and a ranked list
of the three most likely explanations for any deviation is
displayed. Pressing the <Esc> key at this point returns the
user to the rate monitor menu. Pressing the <Enter> key
causes a new window to open, which contains a list of all
possible explanations for deviation from guidelines. A
"certainty" value (ranging from 0.00 to 0.99) indicating the
validity of the explanation is listed with each explanation.
If the list of explanations cannot be displayed entirely
within the window, the list may be scrolled or paged as
described in Section 3.3. Pressing the <Enter> or <Esc> key
returns the user to the rate monitor menu.

6.2.6 ESTIMATES

The estimates option causes the estimate function to be
executed. This is discussed in detail in Section 6.4.

6.2.7 QUIT

The quit option removes the rate monitor menu and returns the
user to the SME executive menu.

6.3 RATE MONITOR COMPARE FUNCTION

The rate comparison function is similar to the growth
comparison function (Section 5.3) in that it plots
performance data from other projects on the current plot.
However, instead of plotting a single measure's performance
data, the rate comparison function plots performance data as
a cumulative ratio of the current measures. The following
sections detail the use of the rate comparison function.

6.3.1 GENERAL INFORMATION

On entry into the rate comparison function, the rate
comparison menu is displayed at the top of the screen. As
with the growth comparison menu, the rate comparison menu
contains four options for selection: view, project, context,
and quit. Initially, the project option is highlighted as a
default. Figure 6-3 presents the rate comparison menu.

```
 View       Project   conteXt                                          Quit

 Plot a comparison project.
```
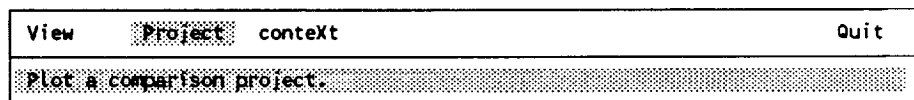
Figure 6-3. Rate Comparison Menu

This release of the SME supports all options displayed in the
selection menu. These selections are described below.

6.3.2 VIEW

The view option temporarily removes the rate comparison menu from the screen to uncover the entire plotting area. Once the plot is uncovered, pressing any key restores the menu.

6.3.3 PROJECT

The project option permits the user to select a project for comparison with the current project. A pop-up window appears containing a selection list of all projects that have data for both the current measures. Any project on the list may be selected. Section 3.2 presents detailed information on choosing items from a selection list.

If the user selects a comparison project, the rate comparison menu is removed and the performance data for the selected project is added to the current plot. Pressing any key restores the rate comparison menu. Figure 6-4 presents a sample rate comparison plot.
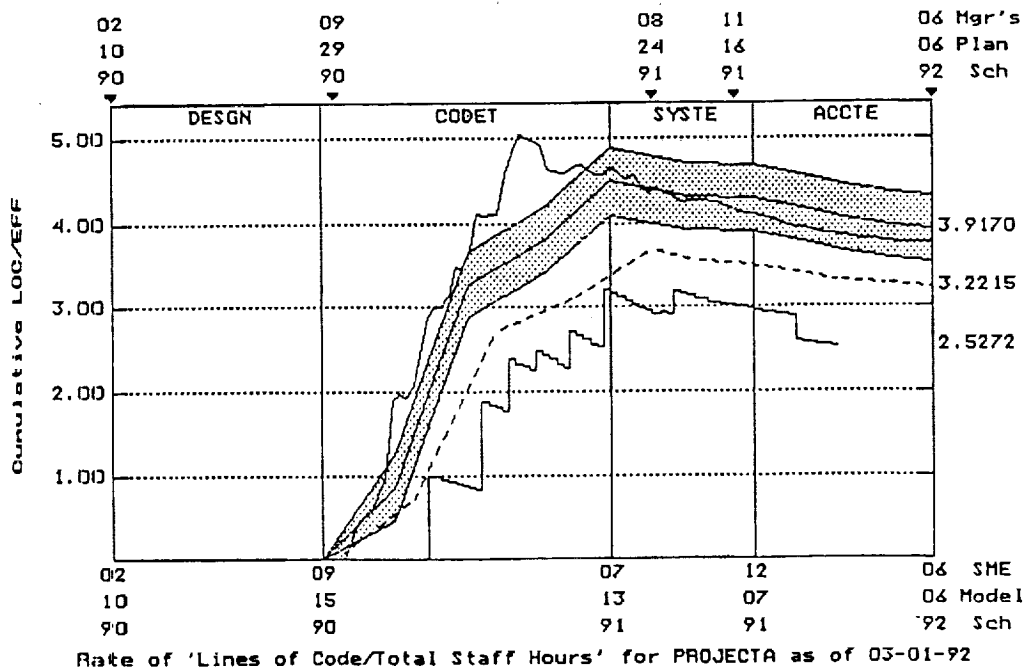
Figure 6-4. Sample Rate Comparison Plot

The rate comparison plot has the following features:

- The ratio type, project name, and project date appear in the plot title.

- The SME schedule template for the four life-cycle phases is displayed across the bottom edge of the plot; the manager's schedule is displayed across the top edge of the plot, along with the phase names.

- Optional guidelines (Section 9.2) representing a model of a typical project are shown as a blue-shaded region with the nominal, minimum, and maximum expected growth curves for the ratio of the measures highlighted in light blue. The guidelines

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are labeled in on the right edge of the plot in
blue with what the SME considers normal for the
rate for a project of this type.

- The ratio of the manager's projected growth for the
  two measures is optionally displayed (Section 9.3)
  on the plot as a dashed yellow line, labeled in
  yellow at the right edge of the plot with the ratio
  of the manager's completion estimates.

- The project's performance data for the ratio of the
  two measures is shown as a green line that conforms
  to the step-wise, weekly growth of the cumulative
  ratio, and labeled on the right edge of the plot
  with the current actual value of the ratio.

- The performance data for the comparison project is
  shown on the plot as a solid line drawn to the
  current actual ratio value for that comparison
  project.

- Dotted lines appear horizontally on the plot at
  regular intervals and are labeled along the left
  edge of the plot.

6.3.4 CONTEXT

The context option displays a pop-up window containing a
legend of all comparison projects that have been plotted,
including the project name and color and pattern used to
display the projects on the comparison plot. Pressing the
<Enter> or <Esc> key removes the context display.

6.3.5 QUIT

The quit option removes the rate comparison menu and returns the user to the rate monitor menu.

6.4 RATE MONITOR ESTIMATES FUNCTION

The estimates function allows the user to view all the estimates that were made by the manager to date for the current measure. The following sections detail the use of the estimates function.

6.4.1 GENERAL INFORMATION

On entry into the estimates function, the estimates menu is displayed at the top of the screen. The estimates menu contains four options for selection: view, history, tabulate, and quit. Initially, the view option is highlighted as a default. Figure 6-5 presents the estimates menu.

```
┌─────────────────────────────────────────────────────────────────┐
│ View   History  Tabulate                                    Quit │
├─────────────────────────────────────────────────────────────────┤
│ Remove everything covering graph.                                 │
└─────────────────────────────────────────────────────────────────┘
```
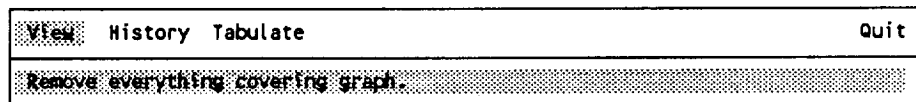
Figure 6-5. Estimates Menu

The view, history, tabulate, and quit selections are described below.

6.4.2 VIEW

The view option temporarily removes the estimates menu from the screen to uncover the entire plotting area. Once the plot is uncovered, pressing any key restores the menu.

6.4.3 History

The history option plots the ratios of all the manager's estimates for the current measures made to date. The estimates menu is removed, and the ratio of the estimated at-completion values for the measures is plotted as a function of the date on which the estimates were made. These values are displayed directly on the rate monitor plot and show the trend in the estimated completion values with time. Pressing <Enter> or <Esc> restores the estimates menu.

6.4.4 Tabulate

The tabulate option displays a pop-up window containing a list of ratios of all estimates made for the measures to date. All estimated completion values and corresponding dates made are displayed. If the list of estimates cannot be displayed entirely within the window, the list may be scrolled or paged as described in Section 3.3. Pressing the <Enter> or <Esc> key removes the list and restores the estimates menu.

6.4.5 Quit

The quit option removes the estimates menu and returns the user to the rate monitor menu.

SECTION 7 - PLANNING FUNCTION

The planning function provides features that enable the user
to create alternative plans interactively. A plan consists
of a schedule and a set of completion estimates. The
function also enables the user to save and delete these
alternative plans. The following sections describe the
planning function in detail.

7.1 GENERAL INFORMATION

When the planning function is selected from the SME executive
menu, the planning function menu is displayed at the top of
the screen. The planning function menu contains seven
options for selection: view, load, update, store, delete,
context, and quit. Initially, the view option is highlighted
as a default. Figure 7-1 presents the planning function
menu.

View	Load	Update	Store	Delete	conteXt		Quit
Remove everything covering graph.							

Figure 7-1. Planning Function Menu

7.2 PLANNING FUNCTION MENU OPTIONS

The following sections describe the view, load, update,
store, delete, context, and quit options.

7-1

7.2.1 VIEW

The view option temporarily removes the planning function
menu from the screen to uncover the entire plotting area.
Once the plot is uncovered, pressing any key restores the
menu.

7.2.2 LOAD

The load option of the planning function menu enables the
user to load either the current baseline plan or a previously
created alternative plan. When the load option is selected,
a pop-up window appears containing a choice between loading
the baseline plan, or loading an alternative plan. If the
user selects baseline, the current baseline planning
information is displayed in a pop-up window. At this point
the user can confirm loading the baseline (by pressing
<Enter> or "y") or abort the operation (by pressing <Esc> or
"n").

If the user selects the alternative plan option, a pop-up
window appears containing a list of all the alternative plans
previously created by the user, if any. If there are no
alternative plans, the SME generates a message to that
effect. If the user selects an alternative plan from the
list, the planning information is displayed in a pop-up
window. As with the baseline plan, the user can now confirm
loading the alternative plan or abort the operation.

7.2.3 UPDATE

The update option of the planning function menu enables the
user to create alternative project plans by interactively
modifying the schedule and/or completion estimate values.
When the update option is selected, a pop-up window appears
prompting the user to choose either the estimates or schedule
for modification. The following sections describe how the
estimates and schedule can be modified to create alternative
project plans.

7.2.3.1 MODIFYING ESTIMATES

Estimate values can be modified in one of two ways: by
editing estimate values individually, or by supplying a value
for a single measure and having the SME supply completion
estimates for the remaining measures by using a model. When
the user selects the estimates option from the plan update
function, a pop-up window appears prompting the user to
select one of these two methods.

The first method, edit, enables the user to enter values for
any or all individual measures. See Section 3.4 for detailed
information on using data entry windows. When the user is
finished editing, pressing return causes a confirmation
prompt to appear. Pressing <Enter> or "y" will cause the SME
to save the estimate values as edited by the user. Pressing
<Esc> or "n" causes the SME to abort the process and restore
the original values.

The second method, model, enables the user to create a set of
completion estimates by entering a value for a single measure

and having the SME create the estimate set by applying that
value to an estimation model. First the user is prompted to
select a measure on which to base the estimate set. Next the
user supplies a value for that measure. After the user has
supplied the value, the SME generates the estimate set and
displays the set in a pop-up window. Pressing <Enter> or "y"
will cause the SME to save the estimate values created from
the model. Pressing <Esc> or "n" causes the SME to abort the
process and restore the original values.

7.2.3.2 MODIFYING SCHEDULES

As with estimates, schedules can be modified in one of two
ways: by editing each individual phase date (except project
start), or by supplying a project end date and having the SME
supply dates for the other phases based on a model. When the
user selects the schedule option from the plan update
function, a pop-up window appears prompting the user to
select one of these two methods.

The first method, edit, enables the user to enter values for
each project phase date except the start of the design phase.
See Section 3.4 for detailed information on using data entry
windows. The dates entered must be chronological by phase,
and the project end date may not be before the date of the
most recent project data. If the user enters an invalid
date, a message is displayed advising the user of the error.
When the user is finished editing the schedule, pressing
return causes a confirmation prompt to appear. Pressing
<Enter> or "y" will cause the SME to save the schedule as
edited by the user. Pressing <Esc> or "n" causes the SME to
abort the process and restore the original values.

The second method, model, enables the user to create a
schedule by entering an end date for the project and having
the SME create the schedule by applying that date (and the
project start date) to a schedule model. As with editing a
schedule, the date entered may not fall before the date of
the most recent project data. After the user has supplied
the date, the SME generates and displays the schedule in a
pop-up window. Pressing <Enter> or "y" will cause the SME to
save the schedule created from the model. Pressing <Esc> or
"n" causes the SME to abort the process and restore the
original values.

7.2.4 STORE

The store option of the planning function menu allows the
user to write the currently loaded plan to disk, thus saving
the plan for future use. When the store option is selected
from the planning function menu, a pop-up window appears
containing a list of previously created alternative plan
names, if any. The user can select a plan name from this
list, or create a new plan name.

If the user selects a plan name from the list and confirms
the store process, the SME writes the currently loaded
schedule and estimate set to the disk file containing the
previous version of the plan selected; thus, the previous
version of that plan will be overwritten.

Alternatively, the user can save the current schedule and
estimate set on disk under a new plan name by pressing <Esc>
and supplying a new 10-character (maximum) plan name. After
the user confirms the process, the SME writes the information

to disk under the new plan name. This plan can be subsequently reloaded by using the load option, described in section 7.2.2 above.

7.2.5 DELETE

The delete option of the planning function menu allows the user to delete previously created and stored alternative plans. When the delete option is selected from the planning function menu, a pop-up window appears with a list of alternative plan names, if any. If there are no alternative plans, the SME generates a message to that effect. The user can select from the list a plan to delete (n.b.: only alternative plans previously created and stored by the user can be deleted; baseline plans cannot be deleted). When the user selects a plan, the SME generates a pop-up window containing the information for the plan the user has selected for deletion. At this point, the user can confirm the deletion by pressing <Enter> or "y", or abort the delete process by pressing <Esc> or "n". Additionally, if the plan the user has selected to delete is the currently loaded plan and the user confirms the deletion, the SME will automatically reload the current baseline plan.

7.2.6 CONTEXT

The context option displays a pop-up window containing a summary of the current planning information. General information such as the project name and type, current plan name and date, and whether the plan has been modified are displayed. The context option also displays the baseline and currently loaded plans' completion estimates and schedules.

Pressing the <Enter> or <Esc> key returns the user to the planning function menu.

7.2.7 QUIT

The quit option removes the planning function menu and returns the user to the executive menu.

SECTION 8 - OVERALL ASSESSMENT FUNCTIONS

Overall assessment provides features for calculating,
displaying, and analyzing high-level project attributes
(e.g., correctability and maintainability). Analysis of
these attributes can help managers reach conclusions about
the overall quality of a project's process and product based
on objective data.

8.1 GENERAL INFORMATION

When the overall assessment function is selected from the SME
executive menu, a pop-up window appears containing a
selection list (Section 3.2) of lifecycle phases for the
project of interest. The user has the option of performing
an assessment for a particular software development phase, or
performing an assessment for all phases of the development
lifecycle. Once the selection is made, the SME generates a
vertical bar graph depicting relative quality indices for the
defined attributes. Figure 8-1 shows a sample graph.
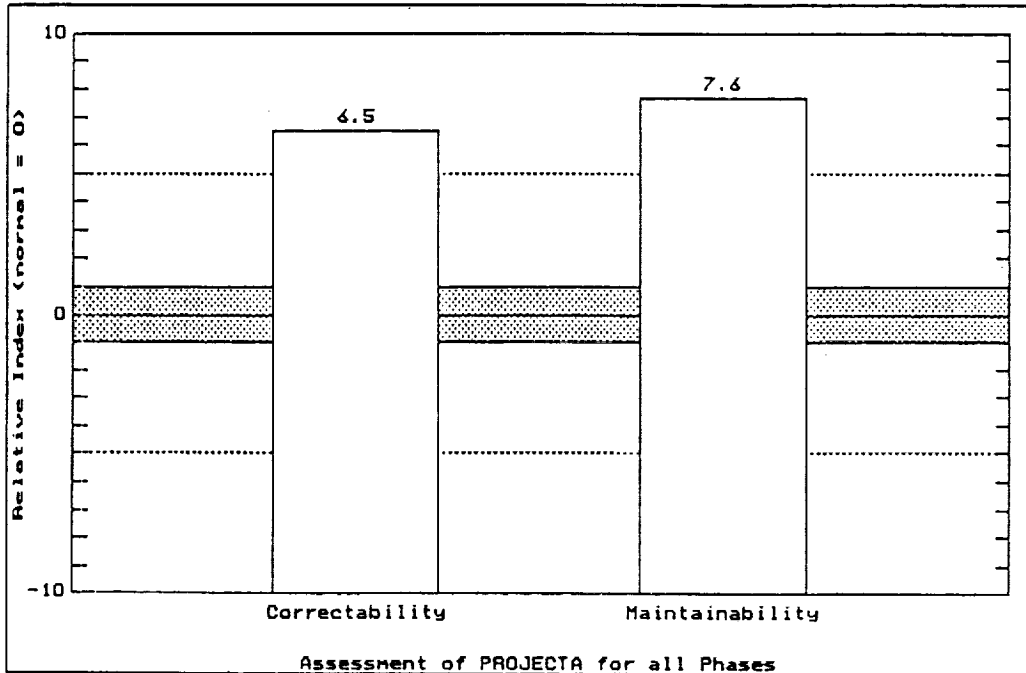
Figure 8-1. Sample Overall Assessment Graph

The overall assessment graph has the following features:

- The project name and phase name for which the assessment is being performed appear in the graph title.

- The graph is scaled vertically from -10 to +10 with 0 being a normal relative index.

- The blue-shaded horizontal bar represents plus or minus 10 percent of normal.

- A vertical bar is displayed for each attribute assessed. If the relative index is greater than or equal to zero, the bar is displayed in green. If the relative index is less than zero but

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greater than or equal to -5, the bar is
displayed in yellow. If the relative index is
less than -5, the bar is displayed in red.

● The numeric relative index value for each
attribute is displayed above the corresponding
vertical bar.

After pressing any key, the overall assessment menu appears
at the top of the screen. The overall assessment menu
contains five options for selection: view, examine, re-
assess, context, and quit. Initially, the view option is
highlighted as a default. Figure 8-2 presents the overall
assessment menu.

```
┌─────────────────────────────────────────────────────────────────┐
│ View      Examine   Re-assess conteXt                      Quit   │
├─────────────────────────────────────────────────────────────────┤
│ Remove everything covering graph.                                 │
└─────────────────────────────────────────────────────────────────┘
```

Figure 8-2. Overall Assessment Menu

8.2   OVERALL ASSESSMENT MENU OPTIONS

The following sections describe the view, examine, re-assess,
context, and quit options.

8.2.1   VIEW

The view option temporarily removes the overall assessment
menu from the screen to uncover the entire plotting area.

Once the plot is uncovered, pressing any key restores the
menu.

8.2.2 EXAMINE

The examine option of the overall assessment menu causes the
examine function to be executed. This is discussed in detail
in Section 8.3.

8.2.3 RE-ASSESS

The re-assess option of the overall assessment menu allows
the user to change, via a selection list, the project
lifecycle phase being analyzed. Once a new phase has been
selected, the current graph is erased and replaced with a new
graph displaying information relevant to the phase selected.

8.2.4 CONTEXT

The context option displays a pop-up window containing a
summary of the current context information. The project
name, plan type, and last date for which there is available
data are displayed. If a particular lifecycle phase is
being analyzed, the phase start and end dates and phase name
are displayed. If the entire project lifecycle is being
analyzed, the project start and end dates are displayed.
Additionally, the measure name, actual, expected, and
estimated data values for all measures used when computing
the relative index are displayed. Pressing the <Enter> or
<Esc> key returns the user to the overall assessment menu.

8.2.5 QUIT

The quit option removes the overall assessment menu and returns the user to the executive menu.

8.3 OVERALL ASSESSMENT EXAMINE FUNCTION

The examine function enables the user to investigate further the strengths and weaknesses of a project by displaying the underlying factors associated with a given attribute. The following sections detail the use of the examine function.

8.3.1 GENERAL INFORMATION

When the examine function is selected from the overall assessment menu, a pop-up window appears containing a selection list of attributes available for further analysis. Any attribute on the list may be selected. Section 3.2 presents detailed information on choosing items from a selection list.

When an attribute is selected for further examination, the graph generated is the same as that generated by the overall assessment function, except the attribute selected is differentiated into the component factors on which the overall assessment is based.

After the <Enter> or <Esc> key is pressed, the examine menu appears at the top of the screen. The menu contains five options for selection: view, attribute, show, context, and quit. Initially, the view option is highlighted as a default. Figure 8-3 presents the examine menu.
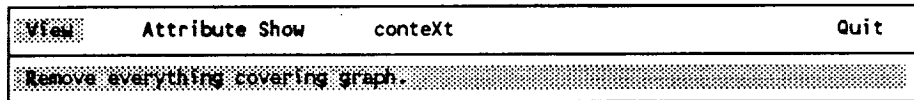
```
┌────────────────────────────────────────────────────────────────────────┐
│ ░View░       Attribute Show      conteXt                          Quit   │
├────────────────────────────────────────────────────────────────────────┤
│ ░Remove everything covering graph.░                                      │
└────────────────────────────────────────────────────────────────────────┘
```

Figure 8-3.   Examine Menu

8.3.2   VIEW

The view option temporarily removes the examine menu from the
screen to uncover the entire plotting area. Once the plot is
uncovered, pressing any key restores the menu.

8.3.3   ATTRIBUTE

The attribute option of the examine menu allows the user to
change the attribute being examined. Once an attribute has
been selected from a selection list, the current graph is
erased and replaced with a new graph of the selected
attribute.

8.3.4   SHOW

The show option of the examine menu generates a horizontal
bar graph displaying the factors that were analyzed in
arriving at the relative index of the particular attribute.
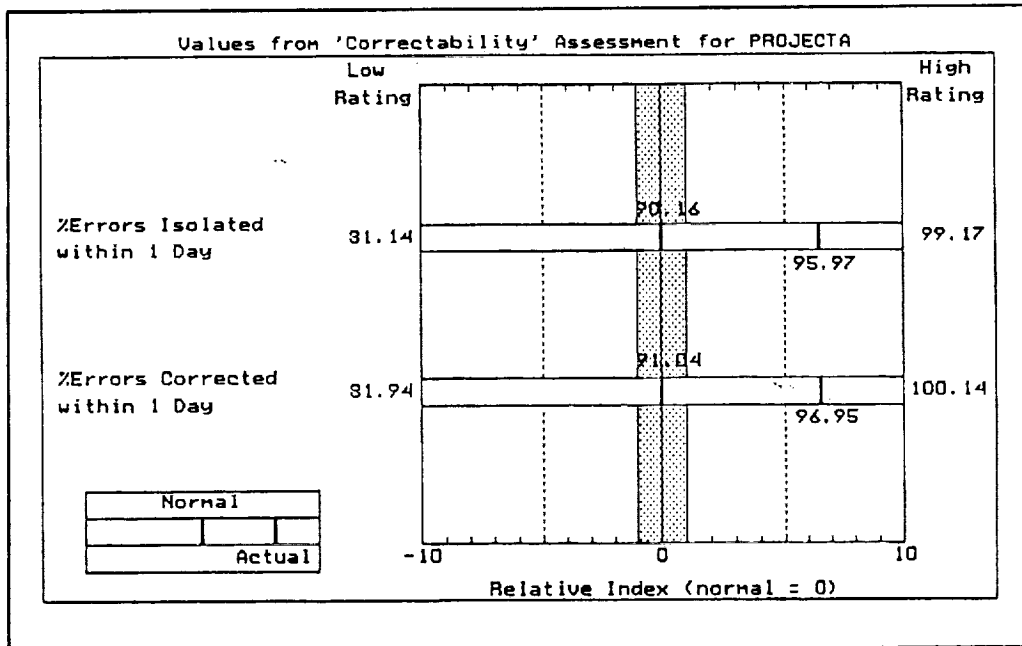Figure 8-4 presents a sample graph.

8-6

```
        Values from 'Correctability' Assessment for PROJECTA
                       Low                                    High
                       Rating                                 Rating

 %Errors Isolated      31.14                                  99.17
 within 1 Day                              70.16
                                                  95.97

 %Errors Corrected     31.94                                  100.14
 within 1 Day                              71.04
                                                  96.95

      ┌──────────────────┐
      │      Normal       │
      ├──────────────────┤
      │            Actual │   -10              0              10
      └──────────────────┘
                       Relative Index (normal = 0)
```

Figure 8-4.   Sample Factor Graph

The factor graph has the following features:

- The project name and attribute being examined
  appear in the graph title.   The factors being
  evaluated appear along the left Y-axis.

- The graph is scaled horizontally from a low
  rating of -10 to a high rating of +10, with 0
  being a normal relative index.

- The light-blue horizontal bars represent a range
  of plus or minus 10 percent of the expected
  value for each factor.   The numeric low and high
  range values appear to the left and right of the
  horizontal bars, respectively.

- The expected (normal) values are represented by
  a vertical red line on each horizontal bar,
  labeled in red with the numeric expected value.

- The blue-shaded vertical bar represents plus or
  minus 10 percent of the high and low ranges,
  respectively.

- The actual data value for each factor is
  represented by a green vertical line on the
  horizontal bars, labeled in green with the
  numeric actual value.

Pressing the <Enter> or <Esc> key restores the examine menu.

8.3.5 CONTEXT

The context option displays a pop-up window containing a
summary of the current context information. The project
name, plan type, and last date for which there is available
data are displayed. If a particular lifecycle phase is being
examined, the phase start and end dates and phase name are
displayed. If the entire project lifecycle is being
examined, the project start and end dates are displayed.
Additionally, the measure name and the actual, expected, and
estimated data values for the measure used when computing the
relative index are displayed. Pressing the <Enter> or <Esc>
key returns the user to the examine menu.

8.3.6 QUIT

The quit option removes the examine menu and returns the user to the overall assessment menu.

SECTION 9 - OPTIONS

The options function provides features that enable the user
to establish display parameters the SME will use when
plotting data. The following sections describe these
parameters.

9.1 GENERAL INFORMATION

When the user selects "options" from the SME executive menu,
a list containing four items appears in a pop-up window.
From this list the user can select the display parameter(s)
to be modified. The user governs whether the SME guidelines
and/or manager's plan is displayed on the growth and rate
monitor plots. The user can also set a project date. This
date determines what baseline plan the SME uses when
plotting, and causes measure data to be truncated to include
only data points recorded up to the project date. The
following sections describe these options in detail.

9.2 GUIDELINES

The first item in the options list, "Turn guidelines on/off",
toggles an internal switch that governs whether guidelines
are displayed on plots. When this option is selected,
pressing <Enter> toggles the internal switch. If on, an area
of the graph is shaded to indicate the nominal value and
expected range (nominal value plus or minus 10 percent) of
the current performance measure for a typical model project.

9.3 MANAGER'S PLAN

The second item in the options list, "Turn manager's plan
on/off", toggles an internal switch that governs whether the
manager's planned growth for the current measure is
displayed.   This option functions the same as the guidelines
option described above in that when selected, pressing
<Enter> toggles the internal switch. If on, the manager's
planned growth appears on the plot as a dashed yellow line.

9.4 PROJECT DATE

The third item in the options list, "Set project date",
allows the user to "travel back in time." When this option
is selected, a pop-up window appears requesting that the user
enter a date. Any date between the project start and end
dates is permissible. When the user enters a new project
date, the SME loads whatever baseline plan (schedule and
completion estimates) was in effect on that date.
Additionally, the data is displayed on plots as it existed on
that date. Thus the user is able to display what the SME
would have plotted, for example, at the end of code and test
phase. The fourth item in the options list, "Reset project
date", simply resets the system date back to the current
date, thus undoing any previous project date entered by the
user.

GLOSSARY

AGSS	attitude ground support system
COF	Component Origination Form
CRF	Change Report Form
EGA	enhanced graphics adapter
FDD	Flight Dynamics Division
GSFC	Goddard Space Flight Center
PC	personal computer
PEF	Project Estimates Form
PRF	Personnel Resources Form
SEL	Software Engineering Laboratory
SME	Software Management Environment
SPF	Services/Products Form
STL	Systems Technology Laboratory

REFERENCES

1. Software Engineering Laboratory, SEL-92-001, <u>Software Management Environment (SME) Installation Guide</u>, D. Kistler and K. Jeletic, January 1992

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