PC TIMS: A SAS® Software Integrated System for Technical Information Management

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ABSTRACT

This paper describes a menu driven technical information system developed at Roy F. Weston Inc. (WESTON) using and integrating SAS® macros and the following PC SAS® Release 6.03 products: SAS/AF® , SAS/BASE® , SAS/FSP® , SAS/GRAPH® and SAS/STAT™ . The application combines data base management, data entry, statistical analysis, reporting tools and high resolution graphics into one system. By using PC SAS as the sole host software package we were able to maximize system performance.

INTRODUCTION

Technical Information Management Systems (TIMS) has been developing at WESTON for years. TIMS was initiated to develop a problem solving computerized methodologies and software for application to meet the environmental objective of conduction site-oriented, multidisciplinary characterization and analyses. It is a computerized system that uses fourth generation mainframe computer hardware and software and includes the application of current technologies for modeling and graphics. It allows hands-on use by engineers and scientist, providing a direct interface to computer models which support environmental site investigations. At present, TIMS is available in two mainframe configurations. Each configuration utilizes highly effective software packages as major components of design that are all interlinked within one system (Table 1). A new "Product Development" practice has been initiated to develop a PC TIMS. The key issues of the adaptation of a TIMS applications on the micro environment are the selection of a host language package, size of the application and system performance.

The SAS System has been the software of choice for statistical computing power, and now more types of PC SAS software are available, such as: SAS/AF, SAS/FSP, SAS/GRAPH and SAS/STAT, which makes a strong case that the PC SAS System is "the" choice of application host language.

SYSTEM REQUIREMENTS

TIMS is required to be a "user friendly" menu driven system. From simple data entry to complicated graphic presentations users can generate a

	UNISYS	VAX
Data Base Management	MAPPER®	ORACLE®
Numerical Surface Analysis and Graphics	CPS-1®	CPS-1®
X-Y Graphics	EZGRAPH®	SAS/GRAPH®
Statistical Analysis	STATPAK®	SAS®

Table 1 WESTON MAINFRAME TIMS SYSTEM CONFIGURATION

variety of reports, data analysis outputs and graphics with just a few keystrokes. Users should not be required to know SAS in order to use the system. An on-line help facility should be made available to users. TIMS also requires a limit on the number of computing environments and software packages (from different vendors) installed so as to reduce as much as possible both captial and technical skill investments. The system should be flexible so that developers are able to modify the system to meet different needs.

SAS TIMS SYSTEMS DESIGN

An information management system emulates the information flow process through application oriented, problem solving capabilities that deliver technical and managerial summaries from the data collected during environmental site investigations. Figure 1 represents the information flow process and functionality of modules.

SAS TIMS utilizes SAS/AF and SAS/FSP as a data base manager to organize the technical data base. Relationships among data files are designed to optimize data storage, retrieval, analysis and reporting. User interfaces established within the system permits access to and manipulation of the data to complement technical evaluations by scientists and engineers. The corresponding automated link between data and the data base is the data entry screen (Figure 2). These menu driven screens closely resemble the formats of data collection forms. Data is simply entered into the system through the corresponding data entry screens.

A major transition exists within the system as data moves from the data base into analysis, allowing output of data in the form of tables and plots summarizing the data collected into compehensive information. The capabilities of Screen Control Language (SCL) in SAS/FSP and SAS macros allow the design of a system capable of multiscreen parameter passing which

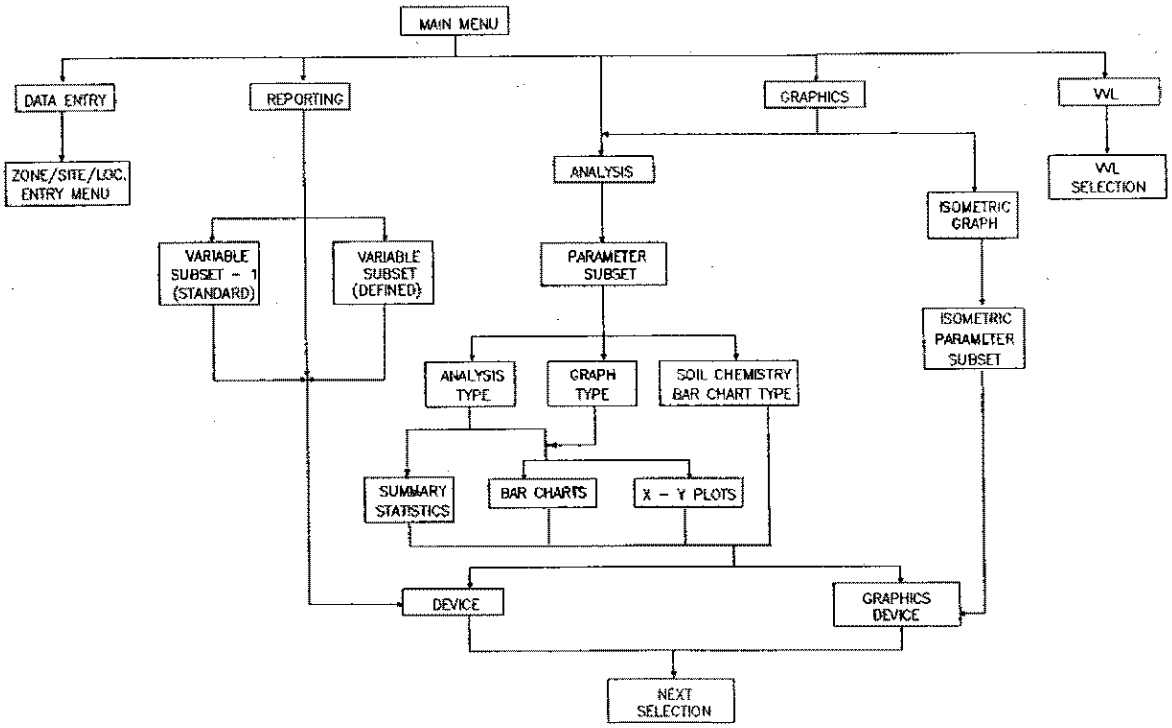


Figure 1 PC TIMS FUNCTIONALITY FLOW CHART

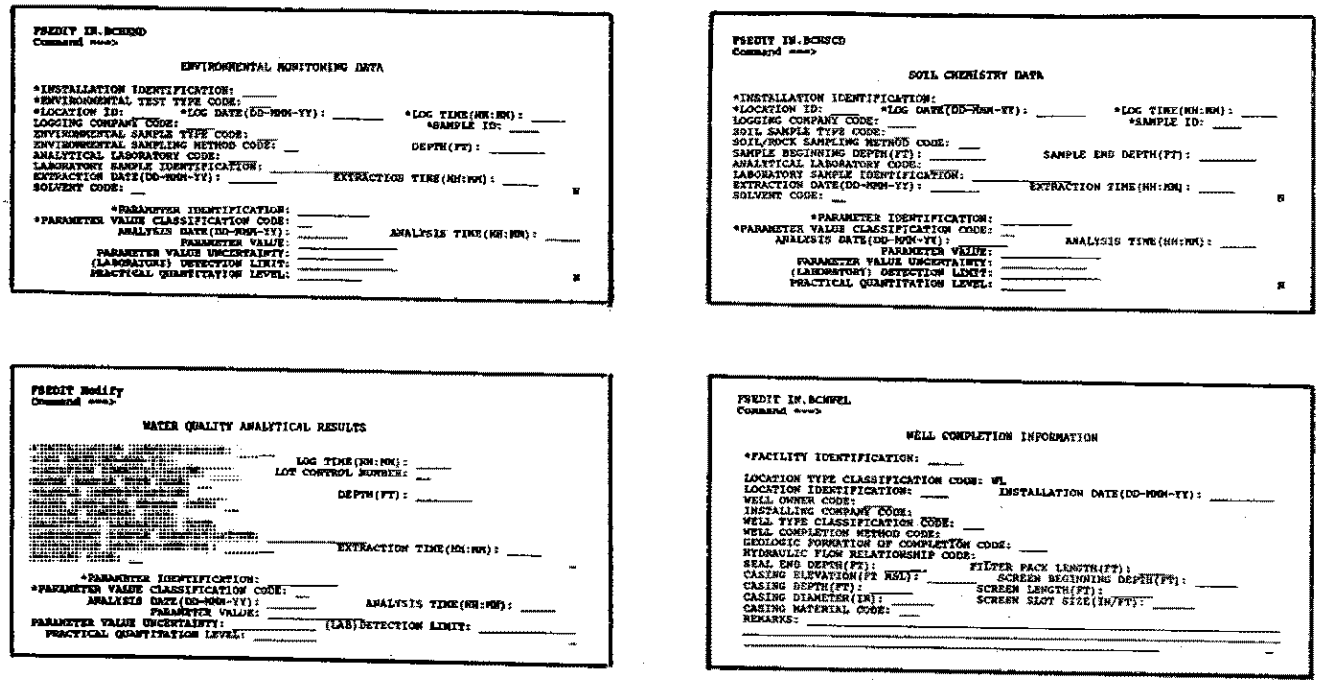


Figure 2 EXAMPLES OF DATA ENTRY SCREEN

results in the reduction of TIMS program size and gains a substantial degree of flexibility and user friendliness. As a result, the same functionality module share the same screen of selection. The easiness of use exists through the system, in the form of prompts, instructions, error messages, formatted screens, selection of arrays, menus, help screens, etc. The well defined functionality modules handle the data in three major categories: a graphical and numerical system for the production of graphical presentations, an analytical system consisting of specially prepared subroutines that perform calculations by data type to produce report quality tables, and a program or model utility that routes the formats required to specific procedures.

The SAS TIMS System consists of five key functional modules:

1. DATA ENTRY/MAINTENANCE
   This module allows the user to access a menu from from which a particular type of data can be selected to add, delete, update or review. The centralized data entry links directly to standard data collection methods and formats. It is a well defined efficient and flexible data base structure to contain data and permit effective data management.

2. DATA REPORTING
   This module allows access to the report menu from which the user can select a certian report to be generated. It provides flexible methods for displaying or reporting information.

3. DATA ANALYSIS
   This module allows access to the data analysis menu from which user can select a particular type of analysis that the user wants done a specific data type. It is a library of customized statistical and analytical programs.

4. GRAPHICS
   This module allows the user to choose high resolution displays of contour, three dimensional, and bar charts on a specific data type. It is a versatile graphics system for generating a variety of graphics and analysis results.

5. VALID VALUE LIST
   This module allows users to browse a list of valid values for specific variables.

Figure 3 and Figure 4 show the examples of functional selection screens and data subset selection screens. Figure 5 shows the examples of outputs from the system.

TIMS MAIN MENU

1. DATA ENTRY/MAINTENANCE MENU
2. DATA REPORTING MENU
3. DATA ANALYSIS MENU
4. GRAPHICS MENU
5. VALID VALUE LISTS

ENTER CHOICE NUMBER : & THEN PRESS <F10>

PRESS <F4> FOR HELP OR <F5> TO EXIT TIMS.

DATA ENTRY/MAINTENANCE SELECTION MENU

1. FACILITY INFORMATION
2. ZONE/STRT/LOCATION DATA
3. LITHOLOGIC DATA
4. GROUND WATER LEVEL DATA
5. WATER QUALITY ANALYTICAL TESTS
6. SOIL CHEMISTRY DATA
7. ENVIRONMENTAL MONITORING
8. PARAMETER DEFINITION INFORMATION

ENTER CHOICE NUMBER : & AND PRESS <ENTER>

PRESS <F4> FOR HELP OR <F5> TO EXIT TIMS.

TIMS MAIN MENU HELP SCREEN

1. DATA ENTRY/MAINTENANCE MENU - This choice will allow access to a menu from which you can select the particular type of data that you wish to add, delete or update.

2. DATA REPORTING MENU - This choice allows you to enter the report menu from which you can select a certian report to be generated.

3. DATA ANALYSIS MENU - This choice allows you to enter the data analysis menu from which you can select the particular type of analysis that you want done on a specific data type.

4. GRAPHICS MENU - This choice allows you to choose high resolution displays of 3-d, contour, and bar charts for specific data types.

5. VALID VALUE LISTS - This selection will allow you to display a list of valid values for specific fields.

Press <F10> to return to the menu.

DATA REPORTING MENU

1. LOCATION REPORT
2. GROUND WATER REPORT
3. WATER QUALITY REPORT
4. PARAMETER DEFINITION REPORT
5. ENVIRONMENTAL MONITORING REPORT
6. LITHOLOGIC REPORT
7. GENERAL FACILITY REPORT
8. SOIL CHEMISTRY REPORT
9. VALID VALUE LIST REPORT

ENTER CHOICE NUMBER : & AND PRESS <F10>

PRESS <F4> FOR HELP OR <F5> TO EXIT TIMS.

VALID VALUE LIST SELECTION

1. LOCATION PROXIMITY CLASS
2. LOCATION TYPE CLASSIFICATION
3. PARAMETER CLASSIFICATION
4. STATE/TERRITORY
5. UNIT OF MEASURE
6. WELL COMPLETION METHOD
7. WELL TYPE CLASSIFICATION

ENTER CHOICE NUMBER : &_ AND PRESS <F10>

ANALYSIS TYPE SELECTION MENU

1. SUMMARY STATISTICS
2. BAR CHARTS OF MEAN VALUE (PARAMETER vs. LOCATION)
3. GRAPH (X - Y PLOT) OF PARAMETER vs. TIME

ENTER CHOICE NUMBER : & THEN PRESS <F10>

SUMMARY STATISTICS SELECTION MENU

Place an X beside the type of analysis you want:

& MEANS

& UNIVARIATE

& SUMMARY

THEN PRESS <F10>

DATA SUBSET SELECTIONS

Data set selected was: &DSTITLE_____

Please specify the FACILITY ID: &FID_

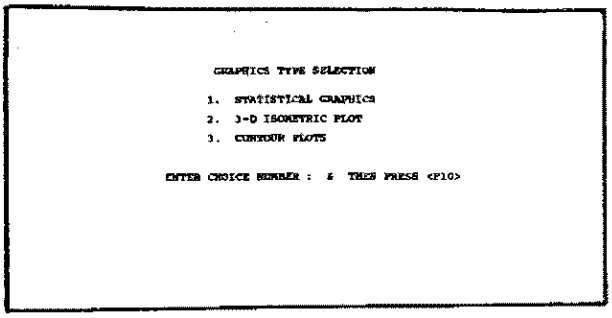
Do you wish to have a standard report (Y/N)?: &

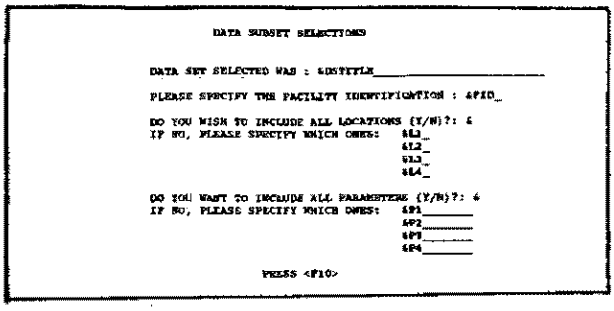
If No, Please choose the variables you want to appear in the report. Place an X beside the desired variable.

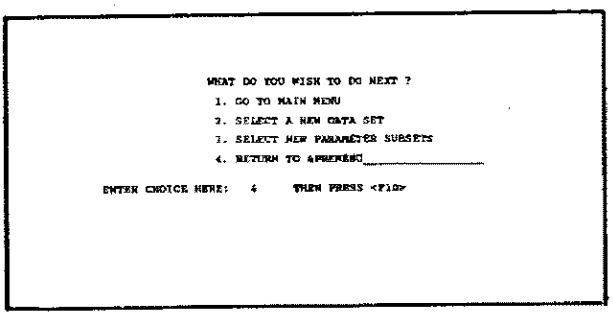
& PARAMETER CLASS
& PARAMETER NAME
& PARAMETER ID
& LOG DATE
& SAMPLE ID
& PARAMETER VALUE
& DETECTION LIMIT
& UNIT OF MEASURE

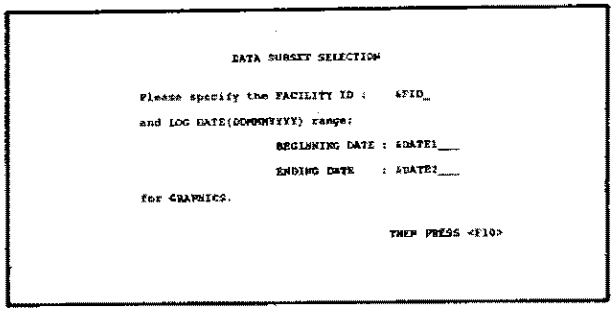
THEN PRESS <F10>

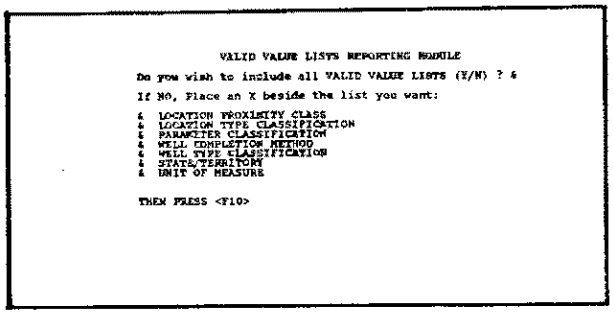
Figure 3 EXAMPLES OF SELECTION SCREEN

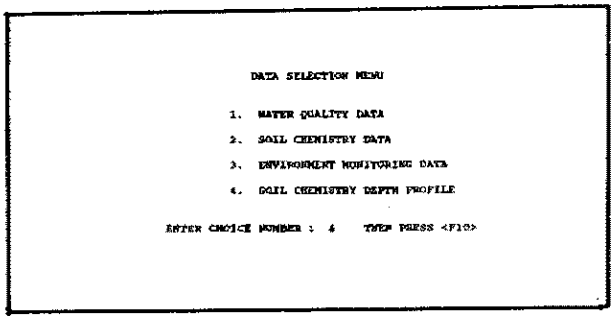


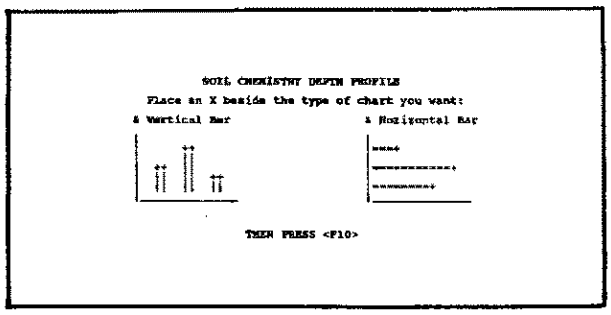












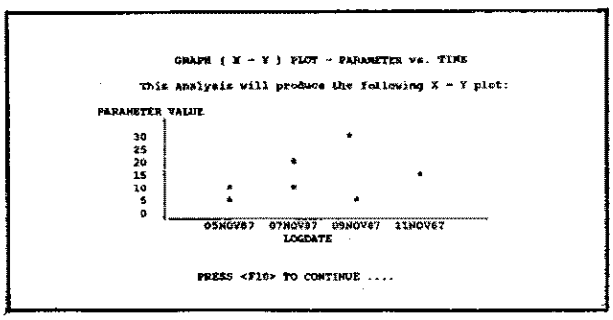
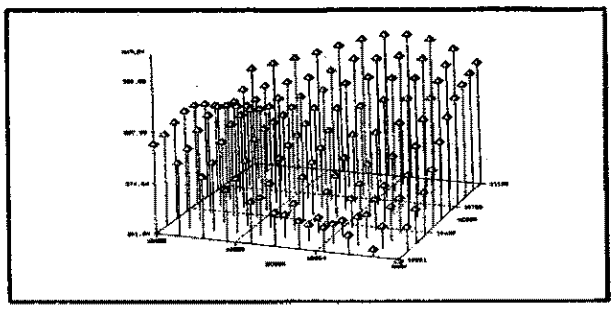
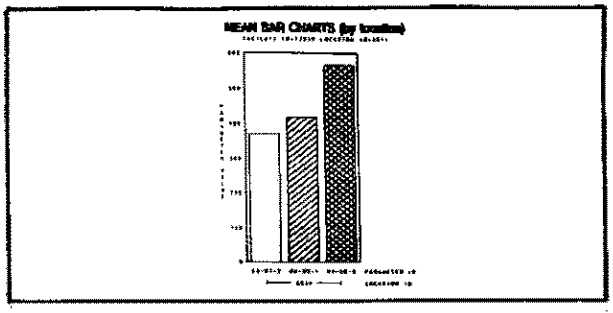
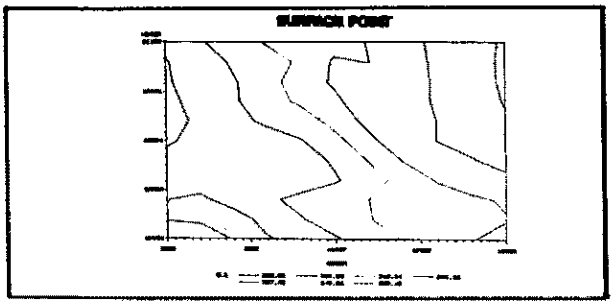
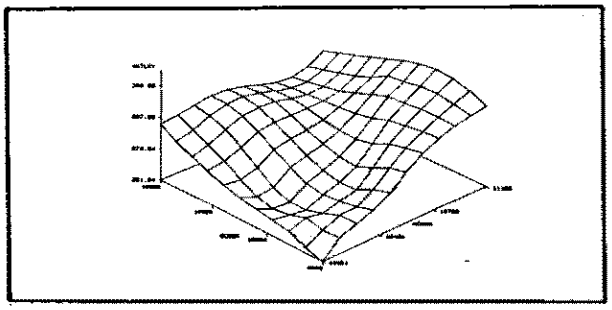


Figure 4 EXAMPLES OF SELECTION SCREEN









GROUND WATER DATA

FACILITY ID = FTHOM

LOCATION ID	NORTH COORDINATES	EAST COORDINATES	ELEVATION	WELL TYPE CLASSIFICATION CODE
MW02	10212.23	9872.93	292.51	
	10212.23	9872.93	292.51	

LOCATION ID	INSTALLATION DATE	LOG DATE	DEPTH TO WATER	WATER ELEVATION
MW02	22OCT87	22OCT1987	26.61	265.90
	02NOV87	22OCT1987	24.06	268.45

LOCATION ID	NORTH COORDINATES	EAST COORDINATES	ELEVATION	WELL TYPE CLASSIFICATION CODE
MW03	10252.60	9792.92	292.53	
	10252.60	9792.92	292.53	

WATER QUALITY DATA
FACILITY ID = FTHOM

LOCATION ID	PARAMETER CLASSIFICATION CODE	PARAMETER NAME	PARAMETER ID	LOG DATE
MW01	MI	ALUMINUM	BZME-W03	30APR88
MW02	MI	ALUMINUM	BZME-W03	30APR88
MW03	MI	ALUMINUM	BZME-W07	22OCT87
MW04	MI	ALUMINUM	BZME-W03	22OCT87
MW05	MI	ALUMINUM	BZME-W03	22OCT87
MW06	MI	ALUMINUM	BZME-W03	22OCT87
MW07	MI	ALUMINUM	BZME-W03	22OCT87
MW08	MI	ALUMINUM	BZME-W03	22OCT87
MW09	MI	ALUMINUM	BZME-W03	22OCT87
MW10	MI	ALUMINUM	BZME-W03	22OCT87
MW2B	MI	ALUMINUM	BZME-W03	12OCT87
MW5B	MI	ALUMINUM	BZME-W03	12OCT87

UNITS OF MEASURE

STMCODE	STMNAME
1/S	PER SECOND
ACRE FT	ACRE FEET
ACRES	ACRES
BARS	BARS
CFS	CUBIC FEET PER SECOND
CM	CENTIMETERS
CM/HR	CENTIMETERS PER HOUR
CM/SEC	CENTIMETERS PER SECOND
CM/YR	CENTIMETERS PER YEAR
CM2/SEC	SQUARE CENTIMETERS PER SECOND
COUNT/L	COUNT PER LITER
DAY	DAYS
DEG	DEGREES
DEG C	DEGREES CELSIUS
DEG C/HR	DEGREES CELSIUS PER HOUR
DEG F	DEGREES FAHRENHEIT
DIGITS	NUMBER OF DIGITS TO THE RIGHT OF THE DECIMAL POINT
DOLLARS	DOLLARS
DYNES/CM	DYNES PER CENTIMETER
E	NATURAL LOGARITHM

SUMMARY STATISTICS

Analysis Variable : PARVAL PARAMETER VALUE

---------- FACILITY ID=CASTL LOCATION ID=420 PARAMETER ID=BZME-W01 ----------

N Obs	N	Minimum	Maximum	Mean	Std Dev
1	1	1.6000000	1.6000000	1.6000000	.

---------- FACILITY ID=CASTL LOCATION ID=420 PARAMETER ID=BZME-W01 ----------

N Obs	N	Minimum	Maximum	Mean	Std Dev
1	1	1.7000000	1.7000000	1.7000000	.

Figure 5 EXAMPLES OF SYSTEM OUTPUT

CONCLUSIONS

A technical information system has been developed at WESTON using and integrating PC SAS Release 6.03. The benefits that have been demonstrated by the TIMS and PC SAS System to an information management system are:

- Provides a simplified computing environment that all data transit between different functionality modules are in the same SAS System so as to reduce as much as possible both capital and technical skills investments.
- Reduces the size of application software and be able to implement it on a microcomputer.
- Provides a centralized and structured data base for all relevant information and rapid, cost-effective information reporting, analysis or graphic presentations of data to guide the design and implementation of data validation.
- Provides a flexible application system that can be customized to meet the different needs and requirements.

ACKNOWLEDGMENTS

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