ABSTRACT

A prevalent challenge for many of today's industrial computer facilities is satisfying the support, service and expertise demands lev­ ened by the user. The programming staff is often backlogged and engaged in long-term projects, whereas the user is typically confronted with short-term computer applications. This paper addresses the successful approach taken by the San Diego Gas & Electric Company (SDG&E) in responding to the needs of its computer user community. SAS (Statistical Analysis System) was adopted as one of the major SDG&E user languages, principally because of its breadth of applicability. A SAS fundamentals course, designed for non-programmers, has been offered to SDG&E employees in support of their growing needs for computer sophistication.

The SDG&E SAS fundamentals course is integrated with a prerequisite course in TSO and SPF. Our SAS course is comprised of ten lecture and workshop periods which cover a five-week interval. Over 15 programming problems are resolved by the users in ten lecture and workshop periods which cover a five-week interval. Each problem is designed to encourage the user to gain experience in the use of SAS for report writing, graphics, file manipulation, data modification and elementary statistical analysis. The success of this course is evident both in the high quality of the SAS programming projects being completed by the course graduates, and in the general recognition of SAS at SDG&E as one of the more powerful computer languages available to the user.

HISTORY

SAS was installed on the SDG&E computer system in January, 1979. The other user languages available prior to this time were: APL, EASYTRIEVE, FORTRAN, and SPSS. The decision to add SAS to the user language base was made by a committee comprised of representatives from various user departments. This committee selected SAS over the other available languages.

During the next two years, SAS began to gain momentum within the SDG&E computer user community. The training for these individuals was accomplished through either public SAS courses, or in-house classes taught by members of SAS Institute. An estimated 40% of all personnel who attended these training sessions subsequently applied SAS to their work responsibilities. Feedback from various trainees suggested that individuals with prior computer experience, and those assigned to the computer staff, benefited the most from these two modes of SAS education. The salient comment from otherwise capable, yet non-practicing, SAS trainees was that the existing SAS training programs presented too much material in too little time for adequate assimilation. The desire to make the SAS education for SDG&E personnel more fulfilling became, therefore, a contributing factor behind the course described in this paper.

Another inducement for the development of a SAS training program emanated from the data processing staff. Limited budget and a moderately-sized applications development staff had created a substantial backlog of both large and small computer projects. Moreover, a significant proportion of the Company's programming activities was being devoted to the maintenance of large-scale systems. The increasing demand for computer services was, therefore, not being adequately satisfied by the programmer and analyst personnel. The SDG&E Information Services Division (see Organization Chart, Exhibit 1), in recognition of this unsatisfied demand, supported the development of a training program for the computer user. SAS was selected as the language to receive the greatest level of training support because of: 1) the potential of the SAS language to accommodate the variety of applications voiced by the user community, and 2) the existence of a higher level of general support for SAS as opposed to the other available languages.

The two predominant factors behind the SDG&E SAS fundamentals course were, therefore, a desire to enhance the productivity of SAS trainees, and to mitigate the demands being placed upon the SDG&E Information Services staff for smaller projects.

Education related to the basics of computing at SDG&E also became recognized as an unfilled need at that point in time. Consequently, a short course in TSO (Time Sharing Oriented) and SPF (Structured Programming Facility) was developed. The course outlines for TSO and SPF are shown in Exhibits 2 and 3. This TSO/SPF program, which is a prerequisite for the SDG&E SAS course, is comprised of three class meetings. Each class meeting entails a lecture session of approximately one hour duration. The lecture is followed by a one-hour lab session. Included as documentation for this TSO/SPF program is a diagram of the SDG&E Time Sharing System, a diagram of different data set structures, a layout of the TSO terminal screen, a listing of the TSO program function keys for normal mode as well as tutorial mode, a Data Processing glossary, data set construction and naming conventions, job execution, and S5014I classes. These materials are contained in the TSO and SPF Student Guides, as well as in the TSO and SPF Training Guide.

SDG&E SAS FUNDAMENTALS COURSE

The SDG&E SAS fundamentals course, initially offered in mid-1981, consists of ten class meetings (see course outline, Exhibit 4). The first three class meetings are accompanied by a workshop period, wherein the student is aided by a learning coach in the completion of his/her SAS workshop exercise. The course participants are confronted with over fifteen problems in a five-week period. Each problem is designed to
incorporate the major SAS techniques presented in a particular class meeting. The assigned problems are reviewed at the beginning of the subsequent class period.

One of the initial challenges for the SAS course participants is the successful running of a SAS program. The mechanics of performing this task are presented in the first class meeting, and are included in the first workshop session. Exhibit 5 contains the statement of an example SAS program for the first session. The SAS program, and output associated with this problem are shown in Exhibit 6. The method by which this SAS program was entered and run is summarized by the flowchart of Exhibit 7. A special SAS CLIST (see Exhibit 8) was developed to enable course participants to run their SAS jobs without necessitating knowledge of JCL (Job Control Language) and other system dependent control statements.

The final class meeting focuses upon the theme of continuing support for the SAS course participants (see Exhibit 9 for a sample agenda). Specifically, the orientation of the SDG&E SAS Users Group is discussed, and the services of the SDG&E Information Center are enumerated, during this period. The class members then describe their current and anticipated SAS projects to their classmates and to members of the Information Services staff. The class participants thereby gain insight to SAS projects being worked on by colleagues, and they are further guided in the development of particular projects by their Information Services support personnel. The final class meeting concludes with each course participant receiving a certificate, as illustrated in Exhibit 10. This certificate is produced using the GSLIDE procedure of SAS/Graph.

KEYS TO SUCCESS

The SDG&E SAS fundamentals course has served to accomplish the two major goals of increasing SAS trainee productivity and of reducing the demands for small project support placed upon Information Services. An estimated 90% of the individuals who have completed this course are using SAS as part of their daily activity. The popularity of the course is evident from its sizeable waiting list. The success of the course cannot be attributed to anyone particular factor, but rather to the synergistic effect of a host of factors. These factors are enumerated below:

- **The SAS Language**
  The versatility of the SAS language enables users to accomplish, with relative ease, report writing, graphics, file manipulation, data modification and statistical analysis.

- **SAS Documentation**
  Documentation which accompanies the SAS language is both well written and readily accessible. The documentation serves as a convenient reference for individuals enrolled in the course, as well as for the general computer user community.

- **Individually Selected Students**
  Each student enrolled in the SAS fundamentals course is identified as one who would benefit from the course. Such identification is made by supervisors within the Information Services Division, specifically: Decision Support Services, Customer Information Systems, Financial Information Systems, Support Information Systems, and Engineering Information Systems. Achievements of each student, of course, rest heavily upon the motivation of the particular individual.

- **Learning Coaches**
  An integral component of each workshop period is a learning coach assigned to pairs of trainees. The function of the learning coach is to provide guidance to the trainee during the workshop period, to assist in clarification of the course materials, and to readily answer questions which arise regarding the mechanics of terminal and SPF operations.

- **Course Notes**
  The notes prepared for the SAS fundamentals course replicate the overhead transparencies used throughout the program. This allows the student to concentrate on the presentation, and to make only minor notes to improve retention.

- **Course Problems**
  The problems included with the course notes, and from which various assignments are completed, relate to several major Company projects that employ SAS. An example is the data extracted from the comparative study being undertaken to examine the performance of SDG&E and other utilities. Another problem relates to a material control SAS program used by an SDG&E engineering group. A substantial amount of learning takes place for those who successfully complete the course problems. Considerable learning also occurs for those who are unable to resolve a problem due to their misunderstanding of a SAS topic. These individuals are sensitized to material for which they seek clarification.

- **Prerequisite TSO and SPF Course**
  The TSO and SPF coursework, a prerequisite for the SAS fundamentals course, has served to both inform users of the details necessary to perform computing at SDG&E, and to lower the anxiety level of previously uninstructed computer users.

- **Class Schedule**
  The SAS fundamentals course meets by-weekly over a five-week period. The student is, therefore, allowed time between class meetings to study the SAS materials, to experiment with the SAS language, and to work on class problems, while continuing to perform normal work-related duties.

- **Class Size**
  The size of a typical SAS fundamentals class at SDG&E is ten students. This small class size is due to the restrictions of both classroom space and computer terminal availability. For example, the workshop period is scheduled to correspond with the programming staff's lunch period in order to allow the
availability of a cluster of computer terminals for the course participants. The distinct advantage of the small class size is the individual attention afforded the trainee both from the instructor and from the learning coaches.

- Course Instructor

The course instructor is available both inside and outside the classroom for consultation on class problems and other SAS projects the trainee may be engaged in. Moreover, the current instructor has several years of teaching experience related to computers both in private industry and in various university graduate and undergraduate programs.

REPRESENTATIVE SAS APPLICATIONS

Participants of past SDG&E SAS fundamentals course offerings were recently sampled to ascertain the nature of the SAS projects they have become involved with. This section of the paper presents a cross-section of these applications:

"I am presently responsible for coordinating computerized data collection and analysis of various power plant activities. These activities include corrective and preventive maintenance, storeroom material management, equipment performance monitoring, and unit overhaul planning.

SAS has provided our Department with a powerful tool for presenting ideas and information to interested parties.

The summary-submittal nature of the SAS language made it easy to understand and use. The SDG&E SAS coordinators presented the material in a manner which enabled me to begin applying SAS on work related projects while still taking the class!

Thus far, we are tracking maintenance craft work backlogs, worker performance and worker effectiveness savings over time. Personally, I have been able to save time by utilizing the SAS/GRAPH graphic system for producing color plots and charts. Graphics make information easy to understand and give a presentation a professional image. SAS/GRAPH may provide the 'extra snap' that might make the difference between the success or failure of an idea."

Dashall S. Weaks, Senior Engineer, Power Plant Maintenance

"My present uses for SAS are quite limited. Currently, I have made very good use of the PRINT procedure for the numerous 'quickie' reports and 'one-shot' programs I'm often required to write. The various options associated with PROC PRINT have allowed me to produce report-type output in a fraction of the time it would have taken me to do the same job in COBOL.

As for future applications, I do not see myself using SAS for the more complicated tasks. I will, however, incorporate SAS into my assignments whenever I can."

Jim Sturiale, Associate Programmer, Customer Information Systems

"I have developed a SAS program which calculates the monthly income tax accrual for a multi-department public utility. In its present form, the program consists of 37 separate schedules and contains approximately 5700 lines of SAS code. The schedules are designed the same way an accountant would set up workpapers, going from detail to summary with the lead schedule being the actual tax journal entry for the month.

The program considers various items such as:

1. Calculations for federal and state tax;
2. Taxes by department (3 operating, 1 non-operating);
3. Up to 2 extraordinary transactions per year (which are treated separately for tax purposes);
4. Necessary logic for flow through and normalized ITC;
5. Separate deferred taxes on 'balancing accounts';
6. Separate logic for the tax impact of 2 subsidiaries that file a consolidated return with the parent;
7. Interest expense allocation to each department using a rather complex PUC approved technique; and
8. Separate accounting for amortization deferred taxes set up in prior years as well as prior and current year amortization of normalized ITC.

The input to the program consists of ten infiles. These files are updated either monthly, quarterly or annually depending on the nature of the data. There are also approximately 20 variables in the first data set of the program which are updated when necessary. Schedules are developed from each infile and each is summarized in such a way as to make a one observation data set which is merged with the rest of the program logic. This allows me to make a change in any infile and have this change reflected in all appropriate schedules. The final dataset contains one observation and 500 interrelated variables.

The program has not only increased the speed and accuracy of performing tax calculations but provides better documentation as well. It allows us to effectively analyze the 'what if' questions in minutes instead of days. Probably the best feature of the program, however, is ease of modification. The one observation design allows me to make major changes with little difficulty."

Jim Sorensen, Staff Accountant, General Accounting Department
"I am working with SAS about 50% of the
time in my current position to do a multi­
tude of small tasks and several large
projects.

The most extensive program that I have
written in SAS is a workload forecast
system. This program monitors incoming
work requests from seven geographic dis­
tricts and plots actual workload rela­
tive to a previous forecast. The monthly
reports produced contain 20 different
tables and 20 color graphs. The benefits
of this system are that timely reports
for Management can be produced without
a lot of effort or tedious.

Another significant program updates
material cost data. Before the SAS
program, the procedure took 2-3 man
weeks. It now takes one-half hour.

In the future, it appears that the
workload forecasting program will
evolve into a system which tracks,
schedules, and forecasts the thousand
or so jobs received each year."

William Rackliffe, Engineering
Assistant, Distribution Engineering

"I am currently using SAS in two basic
areas. The first area is bid analysis
and vendor performance evaluation. The
second area is inventory control and
group ordering. This area has been the
more successful of the two. I have been
able to subset 187,000 inventory infor­
mation lines and sort them into lists
of similar type items for large group
purchase orders. The results are fewer
inventory shortages, lower prices over­
all and better vendor performance re­
sulting from larger, more attractive
orders.

I have found SAS to be easily learned
and used. The relatively small size
of a SAS program makes it feasible to
write a program to solve a single one
time problem. At the same time, the
language is powerful enough to handle
very complex, difficult and recurring
problems."

Jim Pilant, Buyer, Purchasing Department

PLANNED ENHANCEMENTS

The positive experiences gained by SDG&E
from the SAS fundamentals course have encouraged
further developments within the Company. These
planned enhancements are summarized as follows:

- SAS Video Supplement
  The SAS video course is being considered
  by SDG&E as a supplement to our current
  program in SAS user education. Personnel
  with previous computing background will
  be encouraged to utilize these video
  materials, and thereby reduce the length
  of the SDG&E SAS course waiting list.
  Additionally, individuals currently en­
  rolled in our SAS course could make up
classes by reviewing the corresponding
SAS video materials.
- SAS Support Organization
  Education is only one of several support
  components necessary to provide users with
  an effective computing tool. At SDG&E,
  communication, consulting assistance and
  system maintenance (as well as education)
  comprise the overall SAS support program.
  A project organization is currently under
development to administer the program.
  The organization's focal point will be
  the Information Center and the SAS Support
  Committee (project team). This team will
  consist of SAS coordinators from the sys­
tems programming group, application deve­
lopment groups and the SDG&E SAS Users
  Group. The implementation of a formalized
  SAS Support Organization will enable
  the company to further satisfy the needs
  of the computer user community.

CONCLUSION

The SDG&E SAS fundamentals course has be­
come accepted as a viable approach to training
for many individuals in the Company's computer
user community. The success of the course de­
sign has caused it to become recognized as a
model by which other similar training programs
may be patterned. SAS is now regarded as one
of the more powerful computer languages avail­
able to the SDG&E user.
EXHIBIT 1. SVAE INFORMATION SERVICES DIVISION

EXHIBIT 2. TSO COURSE OUTLINE

EXHIBIT 3. SPF COURSE OUTLINE

12) LECTURE
ADVANCED FEATURES AND FUNCTIONS OF SPF

ADDITIONAL FUNCTIONS
DELETING DATA
REVERSE READING DATA
RENAMING DATA SETS
MAINTAINING PARTITIONED DATA SETS
USE OF PARTITIONED DATA SETS
COMPRESSION PARTITIONED DATA SETS
RE-ALLOCATING A DATA SET

ADVANCED FEATURES OF SPF
COPY
MOVE
DELETE
REPLACE
TEXT ENTRY
TEXT DISPLAY
TEXT OVERLAY

12) LAB PROJECT
SPF FUNCTIONALITY

13) LAB PROJECT
SPF ADVANCED FUNCTIONALITY

11/91
EDG&E SAS COURSE

EXHIBIT 4. SAS COURSE OUTLINE

Objectives

The Statistical Analysis System (SAS) is a computer system for data analysis. The course is intended as an exposition on the SAS Language. The course is not intended as an exposition on statistical analysis methods, nor as a language course for experienced programmers.

Format

This short course consists of ten sessions devoted to lecture and in-class discussion on the SAS Language. The initial sessions also include a workshop period to enable hands-on practice with SAS under the guidance of Information Services personnel.

Each course participant is expected to complete: (1) the reading assignment for each session, preferably before the beginning of the session, (2) a small program during the workshop period, and (3) problems to be assigned each session for review at the beginning of the following session. The assigned problems may be collected at the discretion of the course instructor.

Prerequisites

Fundamental understanding of TSO, SPF, and computer terminal operation.

Access to a TSO terminal, IBM model 3278 (or equivalent).

References

EDG&E SAS Course Notes, Modules 1-5, Management Services Section, EDG&E Support Services Department, Information Services Division, San Diego Gas & Electric Company.


SAS Course Outline

<table>
<thead>
<tr>
<th>Session</th>
<th>Date</th>
<th>Time</th>
<th>Notes</th>
<th>Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Wed.</td>
<td>10:30</td>
<td>Basic Concepts of SAS</td>
<td>SAS Introductory Guide</td>
</tr>
<tr>
<td>2nd</td>
<td>Wed.</td>
<td>10:00</td>
<td>SAS Program Processing Part 1</td>
<td>SAS User's Guide</td>
</tr>
<tr>
<td>3rd</td>
<td>Wed.</td>
<td>10:00</td>
<td>SAS Program Processing Part 2</td>
<td>SAS User's Guide</td>
</tr>
<tr>
<td>4th</td>
<td>Wed.</td>
<td>10:00</td>
<td>SAS Program Processing Part 3</td>
<td>SAS User's Guide</td>
</tr>
<tr>
<td>5th</td>
<td>Wed.</td>
<td>10:00</td>
<td>SAS Program Processing Part 4</td>
<td>SAS User's Guide</td>
</tr>
<tr>
<td>6th</td>
<td>Wed.</td>
<td>10:00</td>
<td>SAS Program Processing Part 5</td>
<td>SAS User's Guide</td>
</tr>
</tbody>
</table>

EXHIBIT 4 (CONTINUED)
Mrs. Figueroa goes to the grocery store on a daily basis to purchase salami, bread, and beer. Her purchases over the last week were:

<table>
<thead>
<tr>
<th>Day</th>
<th>Packages of Salami</th>
<th>Loaves of Bread</th>
<th>Six-Packs of Beer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Tuesday</td>
<td>3</td>
<td>2</td>
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<tr>
<td>Wednesday</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Thursday</td>
<td>2</td>
<td>2</td>
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</tr>
<tr>
<td>Friday</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Saturday</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Sunday</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Assume salami costs $2.39 a package, bread $1.05 a loaf, and beer $2.50 a six-pack. Write and run a SAS program which computes her daily purchase cost.
EXHIBIT 8. SAS CLIST DISPLAY

SAS CLIST EXECUTION OF A SAS PROGRAM CONTAINING A CARDS STATEMENT

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1. Review of assigned problems
   (10:15 - 10:45)

2. SAS application guidelines
   (10:45 - 11:30)

3. SAS User Group
   (11:30 - 11:50)

4. SAS Information Center
   (11:50 - 12:00)

5. Class discussion of current
   and anticipated SAS projects
   (12:00 - 12:15)

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EXHIBIT 9. FINAL CLASS MEETING AGENDA

SAN DIEGO GAS AND ELECTRIC COMPANY

Certificate of Completion

Mark A. McNulty

has successfully completed the
SAS Fundamentals course

JANUARY 6, 1982

R. B. Geyer, Ph.D.
instructor

EXHIBIT 10. SAS COURSE CERTIFICATE