Introduction

The Estimating Department exists to perform the function of integrating large amounts of diverse information into a coherent product, the proposal. Due to customer desires and the amount of the data involved, estimators have become increasingly tied to the use of computer-priced proposals and the structure they impose on a task that used to allow some creativity.

We are now experiencing a change in the amount of dependency estimators have on computer support personnel. Increased computer literacy, encouraged by the computer support section, is creating a new class of estimators who realize that the computer is here to stay and, with languages like SAS®, it is not that hard to use. A new dimension of creativity has returned to their jobs and with it a new enthusiasm to take charge of the basic analysis needed for executive review and negotiation backup.

To a large degree, the success of SAS® and SAS/FSP™ has made this possible.

The Estimating Environment

General Dynamics Corporation is the largest defense contractor in the United States and is a Fortune 50 company. Its 13 divisions employ over 85,000 people. The product lines include fighter aircraft, cruise missiles, nuclear submarines, tanks, space launch vehicles, automatic test equipment, range management systems, data handling systems, building products, and natural resources.

General Dynamics Fort Worth Division is the home of the nation's newest fighter, the F-16 Falcon. It is the Estimating Department's responsibility to develop cost estimating methods and prepare proposals in timely manner. The estimation process consists of the gathering of cost data from diverse functional units, the analysis of this data, and the preparation of a proposal document that is used in contract negotiations with the customer. At General Dynamics Fort Worth Division, the proposals can range in value from several thousand to several billion dollars. Fort Worth Division's Estimating Department generates thousands of proposals each year.

Due to the large volume of proposals, General Dynamics Fort Worth divides the Estimating Department into several groups each specializing in a specific area of business (F-16, Electronic Programs, New Business, etc.) My group, Computer Support, specializes in the sophisticated pricing routines used for large proposals and provides consultation for the rest of the department in the use of the computer.

One aspect of our work involves the integration of new technology into the department. SAS® has been used for a few years and, until recently, was seen only as a successful number crunching report writer. Over the past few months, however, we have begun to build a total reporting and analysis system around SAS®. More on this development later.

Early Uses of SAS®

Early in the pricing process, we receive input from various functional groups. SAS® certification of input streams helps flag erroneous data for correction before submittal into the costly pricing routines.

The pricing routines we use have a limited repertoire of output reports. It is then SAS's job to create custom executive summaries, special cross-listings, and functional cost summaries. The functional cost summaries consist of a break-out of all labor, material, overhead, and other charges categories along the vertical axis with dollars displayed by calendar year along the horizontal axis. This summary has particular value in the eyes of our estimators because it is an extremely useful analysis and negotiation tool.

Sometimes a proposal returns from negotiations with changes. The estimators then want to see the difference between the old proposal and the new update. In addition, they need to have visibility into the source of any differences; basic cost elements, labor dollars, or overhead. A SAS® report was written to meet this need. This variance report was created using a SAS® program several hundred lines long with logic difficult to explain to someone who does not know SAS® (and even some who do). The program works, but it is viewed suspiciously.

PROC FSCALC and SAS/FSP

The standard report chosen to become our prototype was the batch variance report mentioned earlier. The resulting PROC FSCALC version was smaller than the batch version and more easily understandable. A CLIST was wrapped...
around the SAS® code to further enhance the program’s appeal. The basic flow of the system is shown in Figure 1.

The procedure begins when the user logs on to our TSO facility and executes the CLIST named VARIANCE. The CLIST then prompts the user with a query as to what the source of the input data will be; hand input, file input, or a combination. Two classes of input are needed; Proposed data, which is the original proposal, and Update data, which is the new version. One example would be to call in the SAS® dataset containing the raw data for the Proposed version and enter the Update version by hand.

Each file input is first processed by a SAS® module that prepares the raw data for PROC FSCALC. This includes compressing the data into hour and dollar totals for each row of the variance report. Each row represents a cost such as Engineering or Material Expense. The hand inputs bypass this step.

The compressed data is then input into the PROC FSCALC model using the DATA step. The user will then type RUN to enter the data. After the compressed data, if any, is loaded, the user will type in any hand input he desires and then type RUN again. This produces the final report. If it is what the user is looking for, he can have the report printed. If not, he can continue to do what-if exercises with the data.

Problems, Solutions, and Future Plans

In the development of our prototype full-screen system, we encountered two main problems. The first was how to handle missing values. In the variance program, it is a common occurrence to have a row completely undefined. It is vital to the accuracy of the program to know where these undefined areas occur. The second problem was in coaxing the program to print report output to our Estimating printers rather than across the plant in the main computer facility.

The missing value problem was overcome by using deduction rather than an outright test. In the program, several rates are computed by dividing dollars by hours. The missing value comes about when hours equals zero. So instead of testing to see if the rate is a missing value, I test the denominator, hours, to see if it is zero.

The print destination problem was solved by storing the report output in a temporary TSO dataset and then performing a PRINTOFF CLIST. The PRINTOFF CLIST was included in the VARIANCE CLIST and is capable of directing output to our local printers. This feature provides the estimators with fast response.

Objectives for the Future

More and more project estimators are becoming computer literate and, therefore, desire more control of their data processing and analysis. It is my assignment to introduce new hardware and software tools into the department to keep us abreast of the newest technology. SAS/FSP™seems to be a perfect match between the estimator’s desire and our push for an integrated SAS® reporting and analysis system.

Our objectives include:

1. Transform priced data output into SAS® datasets.
2. Generalize our SAS®reporting programs (they are too proposal-specific now)
3. Hold SAS®Basics classes to both train potential programmers and to acquaint the others to the potential of SAS®.
4. Indoctrinate the estimators into interactive full-screen use of the computer.
5. Create user-friendly front end CLISTS that guide the estimator around the nitty-gritty computerese and enter him into the appropriate SAS® product.
Recreate a standard report using PROC FSCALC so that the estimators will feel comfortable with the display.

Other uses in Computer Support for SAS/FSP™ and PROC FSCALC have already been determined. We are building a database for our training program that notifies individuals of courses they are enrolled in, keeps historical data on courses attended, computes cost of the classes, prepares executive overviews which include man-hours expended over time plots and forecasts of future expenditure. We use PROC FSEDIT to perform the database updating and original data input.

Proposals are tracked carefully from the time they are requested to the time they are submitted. Many people and departments are responsible for parts of the package. Consequently, a system has been developed to perform this tracking function. SAS/FSP™ will be used to access this information and display charts, plots, and backup tables at weekly proposal status meetings. Using SAS® in this way enables the data presented at the meeting to be three days more current than was previously possible.

More spreadsheet programs will appear. Spreadsheets can be used to prepare look-up tables that depend on rates that tend to be updated regularly. They can be used to do sensitivity analysis on summary level data. In negotiations, they allow the negotiating team to quickly assess the impact of concessions.

The use of stored SAS® datasets will increase as the advantages of interactive sessions become well known. This will enable the department to integrate the standard SAS® programs into a form the average estimator can use.

The most important applications will come from the minds of the estimators. They are the ones that know best their needs and now, with the proper tools, they have the means to achieve them.

For more details, you may contact:

R. T. Grant, General Dynamics
Fort Worth Division
MZ 1638
Fort Worth, TX 76116
(817) 777-1633

B. J. Collins, General Dynamics
Fort Worth Division
MZ 5700
Fort Worth, TX 76116