The Ventura Division of Northrop Corporation produces jet-powered and propeller-driven aerial target drones for both international and domestic sales. Each aerial target system is a complex entity involving not only the flying hardware and the equipment needed to launch it, but also spares and repair parts and the equipment needed for maintenance. The Ventura Division's Supply Support group has three jobs in relation to these systems. The first job is to identify the spare and repair parts needed to support these systems. The second is to make arrangements to have the parts manufactured and shipped in the needed quantities at the right times. The third job is to create and maintain a detailed combination picture book and parts list--called an illustrated parts breakdown--for related technical manuals.

Statement of the Problem

Until recently, Supply Support had no efficient and reliable means of estimating the man-hours necessary to do these jobs, but relied instead on manual methods to estimate man-hours. Manual methods, however, present two major problems: they yield inconsistent results and, because manual methods are labor-intensive, they don't permit estimating several jobs either simultaneously or in quick succession. These drawbacks are serious hindrances for the Supply Support group. Spares, repair parts, and illustrated parts breakdowns are major elements in Northrop's bids for additional business. To be effective and competitive, the Supply Support organization needs to accurately, consistently, and quickly estimate the man-hours required to prepare these detailed parts lists and accomplish the several phases of provisioning.

Approach to the Solution

Previously, the Supply Support group had worked with Base SAS® software to streamline some domestic and international provisioning efforts. SAS proved to be flexible and easy to use, as it provided for quick turnaround time, custom reports, and formatting the data in a way that was understandable and helpful to the user. This happy experience with Base SAS gave us confidence that we could use SAS to devise an automated solution to our man-hour-estimating problem. Having learned about the power of SAS/FSP® from publications and demonstrations, we decided to combine system clists, Base SAS, and SAS/FSP to create a user-friendly, powerful, and efficient man-hour estimating system.

System Description

In designing the Man-Hour Estimating System, we considered the fact that those who desire information are not always skilled in the use of computer systems or SAS. Adding system clists to the Base SAS software permitted us to develop screen formats, or menus, that allow an inexperienced person to use a few simple keystrokes to make the system work.

Because menu-driven systems require minimal training and documentation, they are ideal for infrequently used systems or for systems used by inexperienced personnel. Using menus to drive the system also provides good structure for the development process. The system's data requirements dictate the menu structure and, in turn, the menu structure provides a framework for the modular development of the system.

The Man-Hour Estimating System incorporates a series of SAS programs invoked by a clist. We devised a method which allows the user to log onto TSO (Time Share Option), execute a clist, and call SAS interactively. The user expends very little effort to enter the system. Once the Man-Hour Estimating System program has been initiated, the main menu appears on the terminal screen. We designed the menu so that information appearing on the screen is uncluttered and easy to read, and data entry fields are placed to require very little cursor movement.

Each option on the main menu, except the option to quit, calls a sub-menu which again prompts the user for information. Primary functions such as data entry, query, and report generation appear as options on the main menu. When the user selects an option from the main menu, the appropriate secondary menu appears. The user is passed from one menu to another based on answers given in prior menus. When the user supplies answers to simple questions displayed on the menu, the responses to these questions return to the clist, and the SAS program obtains the data and handles the user's request. The program will return the user to the main menu until the user specifies the option to quit. See Figure 1.

The clists are the heart of the Man-Hour Estimating System. Clists instruct the user, allocate the files, set the printer parameters, and execute SAS. They also allow the user to choose between a standard remote printer or a laser printer for high quality output. The laser printer selection incorporates a forms overlay command that permits the output to be printed on an official division estimating form.

SAS/FSP creates the input screen for the user. The screen looks similar to an order entry form detailing the variables required for completing a man-hour estimate. The screen format allows the user to enter information into a SAS data set for data management and analysis, and to generate reports with Base SAS software. In addition to its use as an input source, SAS/FSP is an effective inquiry system that not only creates a user-friendly screen, but also allows many users to browse the same data set simultaneously.
We maintain the Man-Hour Estimating System through on-line transactions, which allow us to create and maintain historical records of man-hour estimates by project. Discretely coded data permits us to specially tailor reports, and we can expand the system to include new options or tasks.

System Advantages

Now, the Man-Hour Estimating System provides a consistent, accurate way to estimate the man-hours required for a Supply Support task. The estimating system involves Base SAS, SAS/FSP, and a series of menus that allow the user to select the type of man-hour estimate required.

The advantages of the system are as follows:

- Non-data-processing personnel find it easy to use
- Several different kinds of reports can be published through interface with standard and laser printers; output is of high quality
- The system can be expanded or adapted to include future jobs and to meet the man-hour estimating needs of other organizations
- The system-generated basis of estimate is consistent, so that bidding is consistent
- Automated record-keeping allows us to adjust our bids to reflect reality
- The user maintains a copy of each estimate in the master file database, which can be updated through on-line transactions and viewed on-line by using SAS/FSP
- The time required to do man-hour estimates is reduced by one-half.

Future Improvements

Because we used Base SAS software to develop the system, we can improve it and expand it in concert with the need to operate more efficiently. SAS/AF® can replace the clist menus, making the system even more versatile. We can use SAS/AF to create specially designed menus and screens that would enable the most inexperienced person to use the system. In fact, the user would notice little difference between using the Man-Hour Estimating System with system clists or with SAS/AF.

Utilizing SAS/AF will save both programming time and CPU time. SAS/AF can replace the system clists currently used within the Man-Hour Estimating System and operate the system at a more efficient rate. SAS/AF serves as a “front-end” to SAS systems to create menu screens and connect users with those screens necessary to perform a SAS job and generate output.

In addition, we can modify the Man-Hour Estimating System to fit the estimating needs of other organizations within Northrop Corporation. The basic framework of the system's modular design makes modification easy and allows us to convert an Illustrated Parts Breakdown estimate to a Technical Publications estimate.

Conclusion

The Man-Hour Estimating System is a major improvement to and a more complete system than what has been available in the past. In all, SAS has provided the Supply Support group with a truly management tool that is effective and uncomplicated. It has increased productivity in the Supply Support group, resulting in lower costs. With the incorporation of the aforementioned improvements, the system's cost efficiency could be increased.

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