MECHANIZED SPARE/REPAIR PARTS SYSTEM

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Abstract

The Northrop Corporation, Ventura Division Logistics Group provides an organization for maintaining domestic and international provisioning parts list databases. The Mechanized Spare/Repair Parts System is designed to produce a tailored list of spare/repair parts to meet specific international program requirements. Current applications for this system are jet-powered and propeller-driven target drones. The Mechanized Spare/Repair Parts System incorporates coded data elements in MIL-STD 1552/1561 format in order to utilize a system of SAS® programs to manipulate the data. Discrete coding of the data enables the user to extract specially tailored part lists to satisfy program requirements based on customer requests.

The System incorporates a series of menus that allow the user to select the criteria that will be used to meet specific program requirements. The user maintains part number databases through online transactions.

The advantages of the System include ease of use by non data processing personnel, flexibility in the type of reports that can be published (flight profiles based on the number of targets and the flights per target), capability of being expanded to include future products, and high quality output.

The System is capable of being expanded to include new products, in addition to tying in with a yet-to-be established pricing/estimating system which is based on the reports published by the Logistics Group through the Mechanized Spare/Repair Parts System.

Statement of the Problem

In 1981, the Logistics Group of Northrop Corporation, Ventura Division sought to replace its existing spare parts provisioning system for international target drone programs with a new system that was easier to use and more automated. The system prepares reports used by Project Office/Marketing in conducting negotiations with international customers on target-drone-system sales contracts.

The old spare parts provisioning system program consisted of several major components: program, update, query, and report generation. The spares program comprised several boxes of 80-column punch cards that were submitted to the Computer Operations Group for overnight batch processing each time a spares report was required. The Logistics Group was primarily responsible for maintaining these punch cards. In order to update the spares database, batch transmittal sheets with the required information were submitted to Key Processing for input. In addition, the Logistics Group was required to generate an 80-column punch card for each spare part item. If the Logistics Group wished to query the database, a hard-copy output of the entire file was required. Reports were issued in response to customer requests for parts lists based on specific reflight profiles.

Reflight profiles are established according to the method of recovery used for the target (over land or over water) and the number of reflights requested for individual end items. The required report can be for the basic vehicle, optional systems, ground support equipment, peculiar support equipment, consumables, or any combination of the aforementioned items. Each reflight profile represents a single report, which meant that one day of processing time was needed for each report requested under the old system. The Logistics Group's response time to a customer request corresponded to the number of reflight profiles requested -- normally four to six days. In addition, the old system could not easily be expanded to encompass new products or be modified to run an unusual request that would produce an altered version of the standard spare parts reports.

In order to expand the program to allow for the incorporation of a new product, batch transmittal sheets were issued to Key Processing to input the end item into the provisioning database, and items (individual part numbers) that were to be spares were punched on 80-column punch cards. As new products were added, the number of punch cards in the system increased proportionally. Modification of the standard spare parts list required the help of a programmer, and historical records of part number changes were not kept.
This system became more and more outdated and inefficient to use, due to the ever increasing number of products and customer requests received by the Logistics Group. The need for a more automated system became clear. The Logistic Group needed a language or system that was relatively simple to apply, quick to develop, and easy to use.

**Approach to the Solution**

At that time, the Logistics Group began experimenting with Base SAS Software in order to streamline its domestic provisioning tasks. SAS proved to be flexible, easy to use, provided quick turnaround time, created custom reports, and formatted the data in a way understandable and useful to the user. It enabled the Logistics Group to produce tailored reports pertinent to a particular task with little time invested in programming. SAS allowed the Logistics Group to respond much faster to new and existing tasks on both international and domestic programs. Most of the Logistics Group's efforts center around international (foreign) and domestic (U.S. military) sales programs which encompass various products.

After a preliminary study, the decision was made to convert the batch system to an on-line system employing a series of SAS programs. This new system, the Mechanized Spare/Repair Parts System, enables the Logistics Group to produce a multitude of reports in a single day instead of one report per day with the old system. It allows the Logistics Group to produce reports on demand without sending report requests to the Computer Operations Group. Comparison of the old Spare/Repair Part System with the new Mechanized Spare/Repair Part System is presented below in Table I.

**System Description**

In designing the Mechanized Spare/Repair Parts System, consideration was given to the fact that those who desire the information are not always skilled in the use of computer systems or SAS. For this application, the problem was solved by employing Base SAS Software and system clists. With system clists, screen formats are established to allow an inexperienced user to obtain the necessary information with a few simple keystrokes. The Mechanized Spare/Repair Parts System consists of a series of menus displayed to the user, with the user supplying answers to simple questions. In menu-driven systems, the user merely "sees, decides and points" and is required to remember far less information. The responses to these questions then are returned to the clist and SAS code is written to handle the user's request.

Menu-driven systems are ideal for infrequently used systems or for systems used by inexperienced personnel. Minimal training and documentation are

<table>
<thead>
<tr>
<th>REQUIREMENTS</th>
<th>OLD</th>
<th>NEW</th>
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<tbody>
<tr>
<td>Produce Tailored Spares</td>
<td>Batch</td>
<td>On-Line</td>
</tr>
<tr>
<td>Update Database</td>
<td>Batch Transmittal Sheets - Database 80-Column Punch Cards for Spares Items</td>
<td>On-Line Transactions</td>
</tr>
<tr>
<td>Query the System</td>
<td>Hard Copy Output of Entire File</td>
<td>On-Line Access to Database Hours</td>
</tr>
<tr>
<td>Turnaround Time</td>
<td>4 - 6 Days</td>
<td>On-Line Transactions</td>
</tr>
<tr>
<td>Capability for Expansion</td>
<td>New 80-Column Punch Cards Generated and Batch Transmittal Sheets for File Update</td>
<td>High-Quality Laser Printer Output and Standard Computer Output</td>
</tr>
<tr>
<td>Output</td>
<td>Standard Computer Output</td>
<td>Accomplished by the User Available</td>
</tr>
<tr>
<td>Modify Standard Reports</td>
<td>Required Help of a Programmer</td>
<td>SAS® is the registered trademark of SAS Institute, Inc., Cary, NC, USA.</td>
</tr>
<tr>
<td>Historical Record of Part Number Changes</td>
<td>Not Available</td>
<td>SAS/AF™ is the trademark of SAS Institute, Inc., Cary, NC, USA.</td>
</tr>
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SAS® is the registered trademark of SAS Institute, Inc., Cary, NC, USA.

SAS/AF™ is the trademark of SAS Institute, Inc., Cary, NC, USA.
required, and a menu driven system approach also provides a good structure for the development process. The data requirements of the system dictate the database design, the functional requirements dictate the menu structure, and the menu structure provides a framework for the modular development of the system.

The Mechanized Spare/Repair Parts System incorporates a series of SAS programs invoked by a clist. A method was devised which allows the user to log onto TSO (Time Share Option), execute a clist, and call SAS interactively. The effort required by the user to enter the system is minimal. The inexperienced user is able to access the system's menu after logging onto the system. Information appearing, or to be entered, on the screen is uncluttered and easy to read. Data entry fields are positioned to facilitate minimum cursor movement.

Once the Mechanized Spare/Repair Parts System program has been initiated, the main menu appears on the terminal screen. 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 while including subordinate functions on lower-level menus. The user need only select an item number that allows him to specify the criteria necessary to meet customer requirements. The program will return the user to the main menu until the user specifies the option to quit. With this system, the user is passed from one menu to another, based on answers given in prior menus.

The clists are an important process of the Mechanized Spare/Repair Parts System. The clist provides instructions to the users, allocates the files, sets the printer parameters, and executes SAS. The clist also offers the user two options for the printed output: either a standard remote printer or a laser printer for high quality output. The Mechanized Spare/Repair Parts System was developed to be user-friendly, flexible, and capable of producing specially tailored reports that can be modified.

The input data for the international programs reside in MIL-STD 1552/1561 format. MIL-STD 1552/1561, entitled "Provisioning Technical Documentation", is the standard prescribed by the military for provisioning exercises. It defines the record format for the domestic provisioning databases. This format was chosen in order to maintain similarity between international and domestic provisioning databases.

International provisioning databases are maintained through on-line transactions which allow creation and maintenance of an historical record of part number changes. Discrete coding of the data enables the user to extract specially tailored reports to satisfy customer requirements. Expansion of the system to include new options can be accomplished by the user. For example, in provisioning new optional equipment for target drone systems, the input data is specially coded by the Logistics Group to produce a spares list for that item. In addition, the Logistics Group can maintain report headings without altering any of the SAS programs in order to accept new products or changes. Report headings or titles reside in a sequential file that is called in by SAS. With this title file, the Logistics Group can easily add, delete, or change titles without having to deal with SAS code.

Future Improvements

Since the system was developed with Base SAS Software, improvements can be made to the Mechanized Spare/Repair Parts System that would enable it to operate more efficiently. SAS/AF™ can be utilized to replace the clist menus. Using SAS/AF would bring the power of the SAS system into a more accessible form. SAS/AF can create specially designed menus and screens that would enable the most inexperienced person to use a SAS system without any knowledge of programming. Additional user procedures to incorporate SAS/AF into the Mechanized Spare/Repair Parts System would be minimal; the user would notice little difference between using the Mechanized Spare/Repair Parts System with system clists or with SAS/AF.

In addition to SAS/AF, extensive use of macros would decrease processing time. The Mechanized Spare/Repair Parts System incorporates several SAS programs. From program to program, several steps are identical. By taking advantage of the macro facility, these SAS programs could be streamlined. The macro facility will accept user input during macro execution, retain macro variables across SAS data steps, and conditionally create SAS statements. These three aspects of the macro facility would greatly improve the Mechanized Spare/Repair Parts System. The only noticeable difference to the user would be a more efficient system.

One future major improvement would be to tie this system to the estimating system used for spares-pricing information. The Estimating Group takes the output from the Mechanized Spare/Repair Parts System and furnishes pricing information. Currently the Estimating Group is re-
inputting this information into the Computer System to process their pricing information.

Conclusion

The Mechanized Spare/Repair Parts System provides a major improvement and a more complete system than what has been available in the past. In all, SAS has provided the Logistics Group with a true management tool that is effective and uncomplicated. It has increased productivity in the Logistics Group which translates into lower costs. With the incorporation of the aforementioned improvements, the system's versatility could be increased.

Any requests, comments or suggestions should be directed to:

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