

TESS, THE EQUIPMENT AND SOFTWARE SYSTEM

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ABSTRACT

A major concern of large data processing organizations is the management of computer hardware, software and communication lines. TESS - The Equipment and Software System was developed to assist in the management and control of these items. Functional capabilities include:

Inventory Control
Vendor Invoice Approval
Budget/Expense Forecasting
Bill To/Charge Back
Configuration Management
Features Accounting

Development objectives included that the system be on-line, easy to use and easy to maintain. These objectives were achieved by using SAS* software.

SAS software was chosen because of the various procedures and facilities which are included in the package and because of its ease of maintenance. Among the facilities available which are utilized in TESS are the macro language, %INCLUDE, stored formats and SAS/FSP* software. By combining these facilities an on-line system was created which enables users to interactively edit or browse data files. In addition, a MASTER file update system was created for applying the on-line changes to the Master files. This system is made up of a series of modules which are conditionally executed based on the transactions generated from the on-line files.

TESS OVERVIEW

Introduction

TESS is an on-line system designed to assist in the management and control of computer hardware, software and communication lines. Functional capabilities include:

Inventory Control
Vendor Invoice Approval
Budget / Expense Forecasting
Bill To / Charge Back
Configuration Management
Features Accounting
Lease / Warranty Expiration Notice

Insurance Coverage
Maintenance Coverage
Investment Tax Credit

TESS benefits include a reduction in the number of personnel required to manage hardware and software assets, increasing control over these assets, eliminating vendor overpayments, minimizing contract cancellation penalties, and providing accurate up-to-date information.

TESS Functional Capabilities

Many users in an organization can benefit from TESS.

- * Network and Operation Managers can use TESS to determine physical location and equipment addresses and connectivity data.
- * Financial Services personnel can use TESS to assist in the vendor invoice verification and approval process, and also to charge equipment back to end users.
- * Contract Administration personnel can use TESS to record contract information and determine when contracts need to be reviewed.
- * Planners can use the expense budgeting and forecasting capabilities of TESS.
- * Auditors can use TESS to create inventory listings.
- * The Insurance Department can use TESS to determine the amount of coverage required.
- * The Tax Department can use TESS to ensure that all investment tax credits and recaptures have been claimed.
- * Inventory Control

TESS provides accurate location control via a two-character State Code, two-character City Code, and five-character user defined location code (with narrative descriptions). The State/City codes are used for sales tax calculations in addition to being location identifiers.

*** Vendor Invoice Approval**

TESS facilitates the invoice approval process and assists in the reconciliation of disputed amounts.

All contract and costing information is maintained in TESS. Items are "grouped" together for invoice approval by assigning a billing reference number to each item. TESS calculates and reports the amounts due to vendors and accurately reflects:

- partial payments
- varying payment frequencies
- contract changes
- price changes
- sales taxes

Future price and/or contract changes are entered anytime and used based on their effective date.

The Vendor Payable Reports include a summary which shows, for each billing reference number, the invoice total and the breakdown of the total to specific expense types within cost centers; a detail report which shows each item on each vendor invoice; and a cost center recap which shows, by cost center, all items that were scheduled for payment that month. Thus, TESS invoice approval allows the user to eliminate vendor overpayments.

*** Budget / Expense Forecasting**

To assist in the budgeting process, TESS provides a one-year Expense Projection. The one year reporting period is selected by the user and the report shows all costs (i.e. lease, rent, depreciation, maintenance) by month and provides totals by item number, vendor, expense type (user defined), cost center, and a grand total. Future vendor price increases are considered in the forecast (i.e. when a future price increase is input the system will use the new price in the forecast based on the start date entered.) This feature simplifies the yearly, time consuming, manual budget preparation.

*** Vendor Price Changes**

Prices may be entered in an Item Cost Table as opposed to in each individual item record. This makes price changes easier to apply, as many similar items will be priced the same under a common contract. Multiple cost segments may exist. This allows price increases to

be input with a future effective start date. When the start date is reached the new price is used for invoice approval, expense forecasting, and charge back.

*** Bill To / Charge Back**

TESS has a flexible bill to/charge back capability that includes the ability to charge standard bill to amounts or actual costs, charge different amounts for similar items, charge one item to multiple users (i.e. split the cost), partial month billing, one-time billing, billing adjustments, and the ability to utilize bill to agreements or contracts with end users.

On a monthly basis Chargeback (Bill To) Reports are initiated to create the billing information. One report is by Bill To ID which shows each item in detail and can be used to invoice the user, another is a summary report of totals by Bill To ID, and third is a summary of credits to the cost centers that the equipment was originally charged to (i.e. for the vendor expense).

*** Configuration Management**

Configuration information includes: the primary device address and up to seven alternate addresses, system and group IDs, application identifiers, user and service contacts, user fields and other useful information. A configuration report that is produced from this information shows the connectivity relationships of the devices.

*** Features Accounting**

The features accounting capability allows the user to account separately for each specific feature attached to an item of equipment. Use of this capability is optional for each specific item. When used, the basic information about the feature is input (i.e. feature ID, when acquired, etc.) and you can optionally enter separate information for pricing, contract, charge-back, vendor, maintenance, etc. If the optional information is not entered, the system assumes that the information for the item that the feature is attached to is accurate for the feature. (For example, if no pricing information is input for the feature, the system assumes that the cost for the feature is included in

the cost for the main item.) Thus the user determines the level of detail at which features will be tracked.

* Lease / Warranty Expiration Notice

TESS provides advance warning of expiring contracts and warranties. In the Contract Table the number of months required for cancellation or review is specified for each contract. Also, a termination charge code and description that specifies the terms (and penalties) of contract cancellation are entered in the Termination Charge Table.

On a request basis a Cancellation/Renewal Alert Report is provided to allow sufficient lead time to review contract alternatives. This feature allows management to make contract cancellation or renewal decisions on a timely basis.

* Insurance Coverage

On the Contract Table a code is specified to identify the type of insurance risk you have (i.e. all risk, no risk, etc.). This code in conjunction with a market price established for each item type in the Item Table is used to produce an Insurance Report that can be utilized to assist in determining the amount of insurance coverage that is adequate.

* Investment Tax Credit

At the item record level a code is entered to specify whether you or the vendor receive the investment tax credit for each item. At your request an ITC Report for a user defined period will list all items that you get ITC for that were added to or deleted from the system. This report is useful to your tax department in reviewing the items available for ITC.

* Maintenance Coverage

The type of maintenance coverage for each item is specified. For items under a separate maintenance agreement, information includes maintenance vendor, contract information and costs, cost center and expense type for maintenance costs, and a billing reference number for use in vendor invoice verification. For items that have maintenance included in the lease/rent payment, the maintenance portion may be identified and accounted for separately.

BACKGROUND

TESS is written entirely using the SAS system with over 12,000 lines of SAS code in 100 separate program modules. The system utilizes the Base SAS and SAS/FSP software products and runs in both OS and CMS environments.

The SAS system was chosen because of its ease of use, its modular design capabilities, and its extensive data management capabilities. Use of SAS software has meant that maintenance and enhancement of the system have been easier.

Several unique SAS features were utilized to make TESS more flexible and to contribute to its ease of use and maintenance.

The %INCLUDE statement contributed to the modular design of the system by allowing a "driver" module to determine which other modules are necessary for processing. This not only reduced development time by allowing testing of small portions of code but prevents execution of unneeded code, reducing execution time.

Use of the MACRO facility provided a method for customizing the system through a series of processing options selected by the user.

The creation of permanent format libraries using PROC FORMAT eliminates the need for maintaining information which may be repeated at several locations throughout the system and allows rapid access to table information.

Finally, the use of SAS Data Sets enabled TESS to make use of the extensive utilities available within the SAS system for managing data, including on-line browse and edit capabilities.

SYSTEM ORGANIZATION

The organization of the data stored in the TESS system is differentiated two ways: the information stored in tables vs. files and data stored in a master library vs. on-line libraries.

Tables vs. Files

TESS makes extensive use of tables in order to reduce data redundancy and allow certain changes to be input once, into a table, as opposed to changing each item affected at the record level. The tables are also used for editing when transactions are entered (i.e. when an item is entered with a vendor code, the vendor code must be valid according to the vendor table.) There are 14 tables that can be utilized. Seven are required and seven are used optionally depending on individual use of the system.

Before adding information to the TESS item file, certain tables must exist. For example, when adding a new item, an item code is entered. This code reflects the vendor and item description. Thus, the vendor and item tables must be established prior to or at the same time as the transaction entry. If the new item is similar to existing equipment, then the table entries would not be required as they would have been input at a prior date.

The tables are built and changed via on-line TESS transactions entered via PROC FSEDIT. You can add, change, or delete information from the tables by using the appropriate action code for the transaction. Table update and edit reports that show all transaction activity, the information before and after a change, and a complete hard copy of the new table are produced each time a table is changed.

Data regarding a specific item is entered into TESS via on-line File Maintenance Transactions. These transactions add, change or delete information for items recorded on the system. Seven selections on the data access menu pertain to item data. Most of the data resides on the item file which consists of a series of six screens or segments of information as follows: (1) base data, (2) lease/rent data, (3) maintenance data, (4) physical location and comments data, (5) bill to data, and (6) configuration data. The base data is required. The other information is input optionally depending on each specific item (i.e. for a leased item the lease information would be input). As mentioned in a previous section, certain tables must be established at the same time (or before) entering item data as some of the information is edited against table data to insure validity.

Master Library vs. On-line Libraries

The Master Data Library is a SAS Data Library consisting of multiple data sets corresponding to each of the tables and files within the system. The data sets in the Master Library are not accessed by the user, being updated only in a batch update run after extensive editing of the information.

Separate on-line libraries for data entry versus inquiry are maintained. The on-line data entry or edit library allows changes to all tables and item files and also is used to request reports. Also, a full range of inquiry capabilities are available on the edit library.

On-line editing of data uses the special FSEDIT screens for defining attributes of variable fields. On-line editing of data entered consists of: ensuring that all required fields are present; verifying numeric fields; ensuring that dates entered are valid; and range checks for certain fields.

A separate on-line library is available for inquiry only. This library looks the same as the on-line edit library but no changes can be made directly by the user; only inquiry capabilities are available. The on-line inquiry library may be used by multiple users at the same time.

Because the system utilizes SAS/FSP, the inquiry capabilities of TESS are very flexible and include such features as:

- * All fields are available as search criteria.
- * The search may be for a single field match or for multiple fields (i.e. all items at a specific location, or all items at that location with a specific contract number at a specific price, etc.).
- * The search may include logic to be applied to the value found in the search field(s) (greater than, less than, equal to, greater than or equal to, less than or equal to).

Reporting

Twenty-four standard reports are available to the user. The standard reports are requested on-line and the user can specify variables and values of those variables to produce specialized reports

Each of these subsystems operates in a similar fashion. First, transactions are generated; next, the batch editing is carried out; and finally the Master Tables and Files are updated and reports are generated. After all three subsystems are completed the on-line files are rebuilt to be made available to the on-line system.

The batch editing consists mainly of verifying item information against the information in the tables. For example, when the item code is entered, the system will check the item table to ensure that the item code entered is valid. Also, at this point, logical relationships within the data are checked. For example, a future contract will be rejected if the start date is before the end of the current contract. The rejected transactions are reported on Edit Error reports and the edited transactions are applied to the tables or master files and update reports are generated.

The organization of the batch update proceeds as follows. Beginning with a single module, the "batch driver," execution of the system proceeds "downward" through modules within each subsystem. The batch driver %INCLUDES each of the "subsystem drivers." These in turn %INCLUDE the transaction building modules for each table and file within the system, and for report requests. Thus, if no transactions are detected for a particular table or file, or for a report request then subsequent edit and update modules are not included.

In order to minimize run time and to avoid accessing unneeded program modules, the batch system functions are executed based on a set of checkpoints which are stored on a SAS data set along with the TESS data files. These checkpoints indicate successful completion of the various steps which make up the batch update. By maintaining these checkpoints it is possible to control execution of the system so that no transactions are "lost" if the system abends. For example, should the batch job abend during the file maintenance update phase, the MASTER data sets will not be updated by SAS. When the batch update is resubmitted, the checkpoint flags will indicate that processing should begin with the file maintenance subsystem. Therefore, the table update modules are not accessed in that run. In addition, the on-line system accesses

the same checkpoint values. If the batch system has not successfully completed then users are not allowed onto the on-line system, thus protecting the previously entered changes and additions.

Batch system processing also utilizes the buffering characteristics of temporary OS disk files. Execution of the batch update begins with the batch driver. This module generates statements to a temporary disk file, the OSINCS file. The last statement in the batch driver is a %INCLUDE of that OSINCS file which executes the appropriate subsystem driver by "including" that module from the source library. Within this subsystem driver %INCLUDE statements are written to the same OSINCS file using the MOD option of the FILE statement. The %INCLUDE OSINCS; will continue reading statements until an EOF is reached. Using this characteristic, processing of the system continues until no more %INCLUDE statements are found in the OSINCS file. At that point the batch update is complete and the on-line files are accessible.

SUMMARY

The SAS system was used to develop a comprehensive on-line inventory management system. The use of a variety of SAS programming tools made it possible to develop a system which is easy to use while providing the extensive edit and update capabilities necessary to maintain accurate information concerning a data center's hardware and software inventory.

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