Purchase Requisition System: A Computer-Based, Internally Paperless, Purchasing and Inventory System

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Abstract

A computer-based system was developed to handle inventory and purchase requisitions.* The system was designed in ORACLE (a relational database management system) (ORACLE Corp., Redwood, CA), on a Digital Equipment Corp. (DEC, St. Louis, MO) VAX system. This purchasing procedure conforms to the policies and requirements for acquisitions of the Federal Acquisition Regulations and the acquisition regulations of the U.S. Department of Health and Human Services. The system generates no internal paper documents.

The Division of Drug Analysis (DDA), Food and Drug Administration, has designed, developed, and implemented a fully functional, computer-based, internally paperless, purchasing and inventory system. The DDA's daily operations and the need for the orderly management of materials from its internal resources require that inventory listings and the locations of thousands of reagent chemicals and supplies be maintained. In addition, listings of hundreds of components of equipment that must be assembled to perform specific activities have to be maintained.

A computer-based system that meets these needs has been developed to achieve the objectives of the timely processing of procurements while adhering to tight fiscal controls. However, none of the reagent chemicals or supplies, and few of the equipment components, are suitably bar-coded by the manufacturers. Thus the DDA was required to establish its own bar-code-based inventory control systems.

In this system, the inventory control numbers are assigned in the purchase requester's initial document. Multiple requests can be merged into a single purchase order without risk of losing the origins of the requests. With the inventory control numbers, received goods and supplies are easily documented as received, bar coded and inventoried, and routed to the requesters.

The policies and procedures for acquisitions are described in the Federal Acquisition Regulations (FAR),[1] and Health and Human Services Acquisition Regulations.[2] The system

Key Words: purchase requisition (PREQ), inventory, bar code

*The software for this system is available upon request.

described here meets all of the documentation and security requirements of these regulations. The FAR uses Optional Form 347 (or purchase order); this form is sent to vendors by agencies and, upon acceptance by the seller, the purchase order becomes a binding agreement. The process begins with the initiation of a request by a user. The system has features for complete product description, automatic quantity and price extensions, and a knowledge-based vendor-selection table. The vendor-selection table includes, for each vendor, a business identification category, according to selected socio- economic status (i.e., small business, large business, woman-owned, etc.). These categorized data (and their equivalent dollar amounts) are used for federal documentation requirements and periodic reporting. The routing of the request through the designated approval authorities is handled electronically, and approved requests may be printed as error-free orders, eliminating tedious and time-consuming retyping. The request may also be downloaded into a PC with WordPerfect® (WordPerfect Corp., Orem, UT)-based purchasing forms, which can be submitted to vendors, directly, by facsimile transmission.

Background

The DDA (St. Louis, MO) is a laboratory division in the Office of Research Resources, Center for Drug Evaluation and Research, U.S. Food and Drug Administration. The purchasing department processes a continuous stream of requests for services, supplies, and equipment to support the analytical laboratories and the research and development activities.

The FAR system, as described, is a manual procedure that moves requisition documents through each step in the procurement process. A requester completes a form listing the vendor information, item, description, quantity, and price. The request is then submitted to the immediate supervisor for the first review and approval. After the initial approval, the request moves through the approval-authority chain, and only after receiving all required approvals is the request sent to the procurement department for final processing. The procurement department verifies vendor addresses, prices, and price extensions; determines total costs; assigns purchase order numbers; and types the purchase orders to be sent to the vendor.

The research and analysis led to the redesign of the purchase requisition system in the ORACLE relational database management system.

A routine followup inquiry to determine the status of a request must follow essentially the same route as the original request. A routine rebuy or a modified rebuy of the same item requires as much time and effort as a new-buy. These authors have observed, as have others,[3] that although agencies make extensive use of computers in most areas, there appeared to be some reluctance to computerize the purchasing function. The first departure from the manual system to a computer-based purchase requisition system initially became a major focus at DDA in 1987, when a Wang (Lowell, MA) computer-based, BASIC program, paperless, request-and-approval system was developed and used for over three years.

In January 1990, DDA upgraded its main computer with a VAX 6310/VMS operating system V5.4 computer system (DEC) for a staff of end-users of about 60 people. DDA's Information Management Branch (IMB) was given the assignment of improving purchasing productivity without changing the basic nature of the purchasing process. A series of research and analysis activities,[4] coupled with computer-systems design, documented the information flows associated with the purchase request/order/payment processes. Ultimately, the research and analysis led to the redesign of the purchase requisition system in the ORACLE relational database management system.

Description

Software

The purchase requisition software is designed in ORACLE with SQL*Plus[5] programming language (ORACLE Corp.) to create database tables for storing and retrieving data.

SQL*Forms,[6] an ORACLE tool for creating and designing user-friendly data entry forms, is used for entering data into the database tables created in SQL*Plus. SQL*Forms provides a standard fill-in-the-form user interface that enhances development productivity and reduces learning time. SQL programming language commands, called triggers, are programmed into the forms to perform special logic or action on a field before, during, and after data input. Flexibility in the design allows ease and convenience of redesign at any time to accommodate user needs. The print controls, written in Pro*FORTRAN (ORACLE

Corp.),[7] allow the ORACLE database to interface with the FORTRAN language commands to:

- Retrieve records from the ORACLE database
- Print the records to a temporary file
- Interface with the word-processing system via a UDP (user-defined procedure) to convert the file into a formatted word-processing document
- Print the word-processing document onto the purchase order form
- Download into a PC-based WordPerfect form, which may be sent directly to vendors by facsimile transmission (work in progress)

Bar-coded inventory number

The bar-coded inventory number has expanded the existing bar-code-based sample/inventory/personal property control systems to tie in with the receiving process to achieve total inventory control over designated items or classes of items. Each item in a purchase requisition is assigned a unique six-digit number, beginning with the two-digit fiscal year. Four additional digits are generated and assigned as each purchase requisition is created. For example, for fiscal year 1993, purchase requisition number 1 would be assigned the number 930001.

When the descriptive items are entered, the six-digit purchase requisition number and a two-digit item number are concatenated (or joined together) to form an eight-digit inventory-control number (i.e., 93000101). If upon receipt an item is designated for inventory control, its inventory control number then becomes a 10-digit bar code number (i.e., 9300010101). The last two digits are an extension to indicate multiple quantities of the same item.

For example, if item 1 of requisition number 930001 had a quantity of 5, five bar-code labels (numbering from 9300010101 through 9300010105) would be generated upon receipt of these items and affixed to the five items. A brief description of the item, bar code, and 10-digit bar-code number are currently printed on each label.

For purposes of security, the user is locked out of the PREQ after each stage of approval, and is prevented from further editing or approving of the PREQ.

Flow of the purchase requisition

The purchase requisition (PREQ) is initiated when the requester enters the PREQ into the ORACLE database. After the PREQ has been reviewed and finalized, the requester supplies the first approval showing its completion. DDA has one, two, or three levels of supervisory approval, depending on the procurement amounts. For the largest procurement amounts, the first-line supervisor provides the first approval, the Branch Chief approves next, and the Deputy Director gives the final approval on those. For purposes of security, the user is locked out of the PREQ after each stage of approval, and is prevented from further editing or approving of the PREQ. PREQs are available for "viewing only" at all times. After all approvals are completed, the purchasing agent processes the PREQ and prints a purchase order for the vendor, or sends a facsimile to the vendor directly from a PC.

For rush orders, or orders of an immediate nature, a hard copy of the PREQ is printed out, signed by the highest approving supervisor, and routed to the purchasing agent, where the PREQ is immediately processed. During this time, the electronic copy is in process. The signed copy is temporarily held until all electronic approvals have been made. The hard copy is then destroyed.

Building the database tables

In ORACLE, all data are stored in database tables, characterized by columns (or fields) of data. The PREQ system consists of four basic database tables for data storage and retrieval: 1) The requisition table stores vendor information, supervisory approval/tracking information for the requester, and accounting/appropriation information to process the purchase order; 2) the items table stores descriptive information about each item for purchase; 3) the justification table stores the justification for the purchase; and 4) the inventory table stores information for inventory tracking and accountability. The unique six-digit PREQ number is used in each of the four tables to tie each PREQ together. To enhance security control, passwords and identification logons are checked when authorization is required.

Database designs

Figure 1 is a main menu form (or screen) with several options that can be selected by the user. When the user enters an option number, the corresponding ORACLE form is "called" (a macro function) from the main menu, or the appropriate print program is called from the operating system.

Screen designs and work flow descriptions

As shown in *Figure 2*, the PREQ number is generated and assigned at creation (screens A, B, and C) and is subsequently used throughout the system as the unique identifying feature for each requisition entered.

By entering a form (i.e., main menu, options 2, 3, 4, 5, and 6) and executing a query (search) on the PREQ number, the user can view or perform required data-entry functions on this requisition. Option 5, Purchase Requisition Status, shows the requester where a PREQ is on the supervisory approval chain (displayed at the top of *Figure 3*), and whether or not the purchasing agent has processed the order (displayed at the bottom of Figure 3). (See *Figures 3 to 6.*)

Selecting option 9 from the main menu calls forth a submenu for accounting and receiving functions, including the bar-coding of inventory. When the order is received, the receiving person enters the receiving report form and performs a query (search) on the PREQ number. Once the order is displayed and price verification and condition of the item is found satisfactory, the receiving person documents this by entering an "F" for final status.

If the item is found unsatisfactory, the receiving person enters "P" for partial or "D" for damaged status, and fills out another form (for partial or damaged items), putting the order in a hold status. This is crucial to the payment of the invoice, because receiving report forms flagged with a "P" or "D" are not issued as accounts payable until the problems are resolved, and the "F" or final status is displayed.

If the item is found in satisfactory condition, the receiving person determines whether or not the item is designated for inventory control, and then distributes it to the requester. (See *Figure 7.*)

If the item is designated for inventory control, the receiving person enters the inventory and bar-coding form, and executes a query (search) on the inventory number. Once the item is found, the receiving person fills in the remaining information necessary for inventory tracking and accountability purposes, and commits this information to the inventory database.

The orderly and efficient tracking of procurements by the assigned inventory control numbers will eventually allow total inventory control of operations to be developed.

The remaining information includes the model and serial numbers, if applicable, and the location (i.e., room number). A program designed for printing bar-code labels is then called from the operating system, and a printout of the label is generated. (See *Figures 8* and *9.*)

Conclusion

The orderly and efficient tracking of procurements by the assigned inventory control numbers will eventually allow total inventory control of operations to be developed.

It is possible to envision persons going through the facility at intervals during off-hours, recording all items and their locations into portable bar-code scanners. This information could then be transferred to the database, the items searched, and the locations

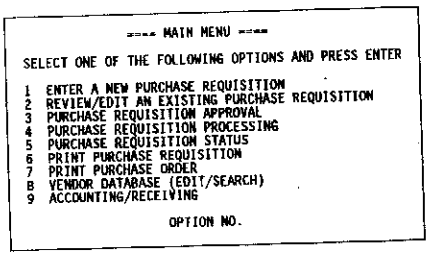


Figure 1 *Main menu form.*

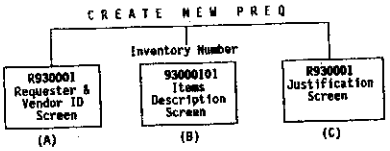


Figure 2 *Creation of new PREQ form (main menu, option 1).*

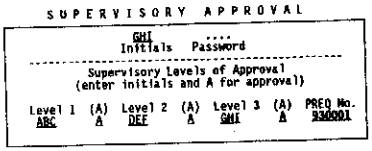


Figure 3 *Requisition status form (main menu, option 5).*

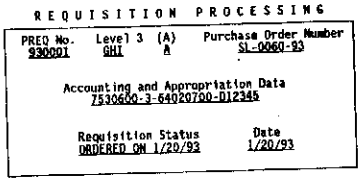


Figure 4 *Supervisory approval form (main menu, option 3).*

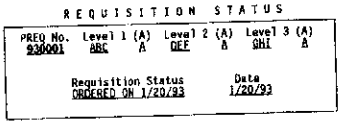
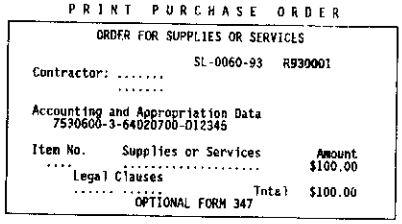


Figure 5 *Requisition processing form (main menu, option 4).*


PRINT PURCHASE ORDER

ORDER FOR SUPPLIES OR SERVICES

SL-0060-93 R930001

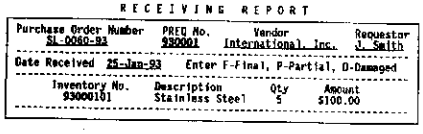
Contractor: .....
.....

Accounting and Appropriation Data
7530600-3-64020700-012345

Item No. Supplies or Services Amount
.... $100.00
Legal Clauses
.... Total $100.00

OPTIONAL FORM 347

Figure 6 *Print purchase order program (main menu, option 7).*

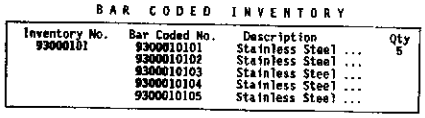

RECEIVING REPORT

Purchase Order Number	PREQ No.	Vendor	Requestor
SL-0060-93	930001	International, Inc.	J. Smith

Date Received 25-Jan-93 Enter F-Final, P-Partial, D-Damaged

Inventory No.	Description	Qty	Amount
93000101	Stainless Steel	5	$100.00

Figure 7 *Receiving report form (main menu, option 9).*


BAR CODED INVENTORY

Inventory No.	Bar Coded No.	Description	Qty
93000101	9300010101	Stainless Steel ...	5
	9300010102	Stainless Steel ...	
	9300010103	Stainless Steel ...	
	9300010104	Stainless Steel ...	
	9300010105	Stainless Steel ...	

Figure 8 *Bar-coded inventory form (main menu, option 9).*

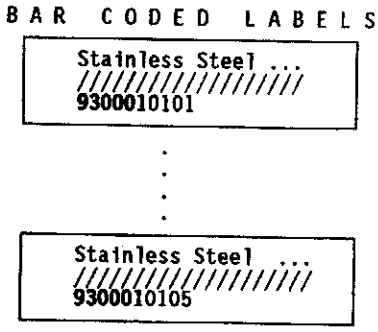


Figure 9 *Bar-coded labels.*

This would result in an even greater savings of time, because there is a drift in inventory that is not readily accounted for in laboratory operations.

identified. This would result in an even greater savings of time, because there is a drift in inventory that is not readily accounted for in laboratory operations, i.e., someone borrows an item and keeps it in his or her location without noting the transfer in the information system.

Acknowledgments

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References

1. Federal Acquisition Regulations, Title 48, Code of Federal Regulations, revised as of July of each year. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.
2. Health and Human Services Acquisition Regulations, Title 41, Code of Federal Regulations, revised as of July of each year. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.
3. Elliott, C. "Purchasing Attitudes Toward EDP"; J. Purchas. Mater. Mgmt. **1976**, 23–7.
4. Logan, S.J. "Analysis of Purchasing System and Recommendations for Automation"; FDA/Division of Drug Analysis: St. Louis, MO 1990. (Internal report available upon request.)
5. Colston, L. "SQL*Plus User's Guide and Reference, Version 3.0"; ORACLE Corp.: Redwood, CA, 1991.
6. Bond, E. "SQL*Forms Designer's Reference, Version 3.0"; ORACLE Corp.: Redwood, CA, 1991.
7. Portfolio, T. "Pro*FORTRAN Supplement to the ORACLE Precompilers Guide, Version 1.3"; ORACLE Corp.: Redwood, CA, 1990.