

PD-ABE-782
79378

Prepared for

Office of Population
Bureau for Research and Development
Agency for International Development
Washington, D.C.
under Contract No. DPE-3024-Z-00-8078-00
Project No. 936-3024

**EVALUATION OF THE NEWVERN
SOFTWARE COMPONENT OF THE
FAMILY PLANNING LOGISTICS
MANAGEMENT II PROJECT**

by

Amy Beam
Betty Case
Douglas Robbins

Fieldwork
March 2-April 30, 1992

Edited and Produced by

Population Technical Assistance Project
DUAL Incorporated and International Science
and Technology Institute, Inc.
1601 North Kent Street, Suite 1014
Arlington, Virginia 22209
Phone: (703) 243-8666
Telex: 271837 ISTI UR
FAX: (703) 358-9271

Report No. 91-137-137
Published September 11, 1992

Table of Contents

Project Identification Data	v
Glossary	vii
Acknowledgments	ix
Executive Summary	xi
1. Introduction	1
1.1 Project Background	1
1.1.1 Management of Contraceptive Commodities	1
1.1.2 Development of NEWVERN	1
1.1.3 Response to 1989 Inspector General's Audit of A.I.D.'s Contraceptive Procurement Program	2
1.2 Purpose of the NEWVERN Evaluation	3
1.3 Evaluation Methodology	4
1.4 Clarification of Key Concepts and Issues	6
1.4.1 Accountability	6
1.4.2 Reliability	6
1.4.3 Dependability	6
1.4.4 User-Friendliness	6
1.4.5 Life Cycle Development	7
1.4.6 Software Maintenance versus Operations	7
1.4.7 Authority versus Responsibility	7
1.4.8 Job Redundancy	7
2. Project Management	11
2.1 Authority and Responsibility of A.I.D. and JSI	11
2.2 Staffing	12
2.2.1 Staffing within JSI	12
2.2.2 Staffing within CPSD	13
2.3 Contractual Deliverables for NEWVERN	14
2.4 Allocation of Time and Resources	15
2.5 PROGRESS Programmers	15
3. Implementation of NEWVERN	21
3.1 NEWVERN Functionality	21
3.1.1 Procurement	21
3.1.2 Order Fulfillment	21
3.1.3 Funding	22

3.2	NEWVERN Accountability	23
3.2.1	Country Reconciliation	23
3.2.2	Expenditures	23
3.2.3	Administrative Approval	24
3.2.4	Inventory Adjustments	25
3.2.5	Acknowledgment of Receipt	25
3.3	Training	27
3.3.1	Training of JSI and CPSD Staff	27
3.3.2	Training of Others	28
4.	Software Development and Maintenance of NEWVERN	31
4.1	Software Design Issues	31
4.1.1	Software Functions	31
4.1.1.1	Functional Document	31
4.1.1.2	Future Development Needs	31
4.1.2	Design Review Process	32
4.1.2.1	Input Procedures	32
4.1.2.2	Software Trouble Reports and Engineering Change Proposals	33
4.1.2.3	Prioritization and Scheduling	34
4.1.3	Functional Design Features for Users	34
4.1.3.1	Screen Design	34
4.1.3.2	Help Messages	35
4.1.3.3	Error Messages	36
4.1.3.4	On-Line Documentation	37
4.1.3.5	Cursor Movement	38
4.1.3.6	Menu Design	38
4.1.3.7	Reports	39
4.1.3.8	Overall User-Friendliness	41
4.1.4	Technical Design Features and Data Integrity	41
4.1.4.1	Structured Programming	41
4.1.4.2	File Relations	41
4.1.4.3	Validation	43
4.1.4.4	Processing Speed and Indexing	45

4.1.5	Security	46
4.1.5.1	Login and Passwords	46
4.1.5.2	Network and Phone Connections	46
4.1.5.3	UNIX File Permissions	47
4.1.5.4	NEWVERN Permission System	47
4.1.6	Programming Standards	48
4.1.6.1	Naming Conventions for Fields, Variables, Files, and Procedures	48
4.1.6.2	Block Headers and End Statements	50
4.1.6.3	Indentation and New Lines	51
4.1.6.4	Capitalization	51
4.1.6.5	Audit Trail	51
4.1.6.6	Internal Documentation	51
4.2	Configuration Management	52
4.2.1	Hardware Environment	52
4.2.2	Software Environment	53
4.2.2.1	Operating System	53
4.2.2.2	Programming Language	53
4.2.2.3	Management of Source Code and Object Code	53
4.2.3	Installation Procedures	54
4.3	System Administration	55
4.3.1	Account (User) Management	55
4.3.2	Backup Procedures	55
4.3.3	Archival Procedures	55
4.4	Quality Assurance	56
4.4.1	JSI Testing	56
4.4.2	A.I.D. Testing	57
4.4.3	NEWVERN Version Releases	57
4.5	Technical Documentation	57
4.5.1	Data Dictionary	58
4.5.2	File Relations	58
4.5.3	Menu Map	59
4.5.4	PROGRESS Procedures	59
4.5.5	Called Procedures and Include Files	60
4.5.6	Directory Structure and Procedures Listing	60
4.5.7	Electronic Data Transfer Specifications	61

4.5.8	Installation and Version Release Procedures	61
4.5.9	Hardware Environment	61
4.5.10	Internal Code Documentation	62
4.5.11	Software Trouble Reports and Engineering Change Proposals	62
4.5.12	Correspondence between A.I.D. and JSI	62
4.6	User Documentation	62
4.6.1	On-Line Documentation	63
4.6.2	Keyboard Use	63
4.6.3	Menu System	63
4.6.4	Reports	64
4.6.5	Lists of Codes and Abbreviations	64
4.6.6	Overview of Responsibility	65
4.6.7	Automated Processing versus Data Entry	65
5.	Summary Recommendations	69
5.1	Exercise Closer Management over NEWVERN	69
5.2	Conduct Software Validation testing	69
5.3	Use Software Trouble Reports and Engineering Change Proposals	70
5.4	Adhere to Schedules for Version Releases	70
5.5	Reduce Paperwork and Work Redundancy	71
5.6	Improve Management Reporting	71
5.7	Improve NEWVERN User-Friendliness	71
5.8	Improve Financial Accountability	72
5.9	Reduce Vulnerability through Improved Documentation	72

List of Appendices

Appendix A	Evaluation Background (Scope of Work, Evaluation Team Members, List of Documents Examined, List of Persons Interviewed)
Appendix B	Sample Software Trouble Reports and Engineering Change Proposals
Appendix C	Survey of USAID Missions (Survey Questionnaire, List of USAID Missions Surveyed, Summary of Responses to Survey Questionnaire, and Discussion of Responses to Survey Questionnaire)
Appendix D	NEWVERN File Structure Map
Appendix E	Recommendations
Appendix F	PROGRESS Corporation Growth Statistics

Project Identification Data

1. **Project Title:** Family Planning Logistics Management II
2. **Project Number:** 936-3038
3. **Mode of Implementation:** Contract administrated by R&D/POP/CPSD
4. **Contract Number:** DPE-3038-C-00-0046-00
5. **Contract Effective Date:** 08/31/90
6. **Contractor:** John Snow, Inc.
7. **Contract Value:** \$20,000,753
8. **Obligations to Date:** \$ 8,101,000
9. **Expenditures on NEWVERN:** \$ 293,329
10. **Project Description:**

NEWVERN is one of several computerized management information systems developed and maintained under the Family Planning Logistics Management contract with John Snow, Inc. NEWVERN documents the procurement, shipment, storage, and financial accounting of A.I.D.-supplied contraceptives.

Glossary

A.I.D.	U.S. Agency for International Development
AIDS	acquired immune deficiency syndrome
A.I.D./W	U.S. Agency for International Development/Washington, D.C.
BAT	budget allowance transfer
CA	Cooperating Agency
CCM	central commodities management
CDC	Centers for Disease Control
CPSD	Commodities and Program Support Division (Office of Population)
CPT	contraceptive procurement table
CPU	central processing unit
CSM	contraceptive social marketing
CTO	cognizant technical officer
ECP	engineering change proposal
FPIA	Family Planning International Assistance
FPLM	Family Planning Logistics Management (project)
FPSD	Family Planning Services Division (Office of Population)
GSA	General Services Administration
IUD	intrauterine device
JSI	John Snow, Inc.
Matrix	Matrix International Logistics, Inc.
MIS	management information system
MS-DOS	operating system for IBM (and compatible) personal computers
NEWVERN	CPSD's software used to manage centralized commodities procurement and distribution to recipients worldwide
Norplant	contraceptive implant
OYB	operational year budget
PASA	participating agency service agreement
PIO/C	project implementation order/commodity
POPTECH	Population Technical Assistance Project
PPD	Population Projects Database
R&D/POP	Bureau for Research and Development, Office of Population
RAM	random access memory
RFP	request for proposal
SOMARC	Social Marketing for Change (project)
S&T/POP	Bureau for Science and Technology, Office of Population
STR	software trouble report
USAID	U.S. Agency for International Development (mission)
VFT	vaginal foaming tablet
VMS	operating system for VAX mainframe computers

Acknowledgments

The evaluation team wishes to thank all of those people we interviewed (listed in Appendix A). Each person made time in his or her busy schedule and was forthcoming in discussions with us. We thank John Snow, Inc., for providing us with on-site office space, a computer terminal, and modem connection. We especially thank William Felling, the developer of NEWVERN, who candidly answered all of our questions and provided us with documentation.

Likewise, the dialogue and direction provided by Carl Hemmer, Chief, Commodities and Program Support Division, Office of Population, and John Crowley, Cognizant Technical Officer for FPLM, also of the Commodities and Program Support Division, were indispensable to this evaluation. Their keen interest in our findings was encouraging, and their receptivity to our recommendations gave us confidence that serious attention will be given to implementing many of our recommendations, which are offered to increase the usefulness of NEWVERN.

Executive Summary

Background

The Family Planning Logistics Management (FPLM) project, implemented through a contract between John Snow, Inc. (JSI) and A.I.D.'s Commodities and Program Support Division (CPSD) in the Office of Population, provides assistance to CPSD in the area of central commodities management (CCM). CCM includes the processes of forecasting and estimating contraceptive needs, contracting with manufacturers for production, processing orders from USAID missions and Cooperating Agencies (CA), tracking funding sources and expenditures, and warehousing and shipping contraceptives to recipient programs worldwide.

The General Services Administration (GSA) originally performed the contracting function for contraceptive procurement. In June 1991, a new centralized A.I.D. project — Central Contraceptive Procurement (936-3057) — was created to accept funds transferred for central procurement of contraceptive commodities. USAID missions and the Bureau for Research and Development, Office of Population (R&L/POP) make operational year budget (OYB) transfers of unobligated current year funds to this project. A.I.D., through its FPLM contract with JSI and an agreement with the Centers for Disease Control (CDC), develops contraceptive procurement tables (CPT) with each country for the purposes of estimating future contraceptive needs. These CPTs are then used by A.I.D. to consolidate annual contraceptive requirements and to award contracts to manufacturers.

Approximately 10 contracts for contraceptives are awarded annually by A.I.D. to manufacturers. In fiscal year 1991, A.I.D. awarded contracts valued at \$58 million. Fulfillment of these annual contracts is done on a monthly basis, thus allowing manufacturers to schedule continuous production and pass substantial savings along to the government. Currently, A.I.D., through centralized procurement of large orders, purchases condoms at about 5 cents each and a one-month cycle of oral contraceptives at about 15 cents each. These costs compare with U.S. retail costs of \$.75 to \$1.50 per condom and \$15 to \$20 per cycle of oral contraceptives.

Development of NEWVERN

In 1987, JSI took over daily operation of CCM functions that were primarily handled manually with paper record-keeping. During 1987 and 1988, JSI automated the CCM functions using a programming language called PROGRESS running on the UNIX operating system on an Altos 386 computer. This multi-user, automated system is housed and operated at JSI in Rosslyn, Virginia. It is accessed via modem by CPSD, CDC, and some CAs. It is referred to as NEWVERN and is a major achievement without which the FPLM program could not operate today.

JSI is not only the developer of NEWVERN, but is also the primary user of NEWVERN, responsible for the system's daily operations. In 1991, JSI, using the NEWVERN automated system, kept track of 520 orders from missions and CAs for over 1 billion units of contraceptives. JSI also tracked 424 payment vouchers from Matrix International Logistics, Inc., the freight forwarder, covering \$4,290,807 in shipping costs.

Contractor Performance

JSI has handled the NEWVERN development in a responsible and cost-effective manner. It has developed a good system for A.I.D. which automates the central commodities management functions. Software development costs have been within typical industry standards, and quite possibly below industry standards. JSI has performed in a manner consistent with the requirements of the FPLM I and II contracts.

Areas for Improvement

Need for Automation of the CPSD Approval Process

Although the contractual agreement between JSI and A.I.D. gave the responsibility for NEWVERN operations to JSI, CPSD maintained the decision-making authority. This separation of responsibility for operations from authority has resulted in the automation of JSI operations, but not the CPSD approval function. In order for JSI to obtain CPSD approval on order processing and commitment of funds, a large amount of paper is shuttled twice a day between JSI and CPSD for CPSD review and signature approval. This approval process has resulted in excessive paperwork and work redundancy. For example, all orders from missions are handled twice each by JSI and CPSD, once prior to data entry and once after data entry.

Hundreds of rules for handling work are programmed into NEWVERN. By approving each rule, CPSD has appropriately exercised its oversight responsibility. It is, therefore, not necessary for CPSD to approve each and every application of the rule. Currently, records stored in the NEWVERN system are replete with names of CPSD approving authorities and dates of approval. In this aspect, NEWVERN is an elaborate note-keeping system. A re-definition of the CPSD approval process could eliminate much of the time spent maintaining this note-keeping system.

Need for Closer Management by A.I.D.

The A.I.D. cognizant technical officer (CTO) for the FPLM contract with JSI has numerous responsibilities, leaving little time for management of the technical aspects of NEWVERN software development and maintenance. Currently, no one within CPSD has enough technical expertise to discuss and respond to technical design issues related to NEWVERN development. Therefore, JSI manages NEWVERN development with very little direction from A.I.D. There is a need for A.I.D. to advocate its own needs and offer more direction to JSI.

Need for Software Validation Testing

The NEWVERN software has not been tested or certified as complete and accurate. Spot testing of NEWVERN identified some software problems. Software validation testing will define needed corrections and offer suggestions for enhancements. The results of testing will provide CPSD with the ability to prioritize its needs and better manage limited resources.

Need to Adhere to Schedule for Version Releases

Currently, JSI and A.I.D. meet annually to develop and approve an annual workplan for JSI. This workplan is general and lacks the necessary specificity and delivery dates for A.I.D. to monitor and measure contractor performance. Additionally, when A.I.D. asks JSI for assistance on a task, JSI's willingness to respond disrupts other work in progress, thus making it difficult for JSI to work according to a schedule and long-range plans. Finally, the programmer/analyst responsible for NEWVERN development is also responsible for overseeing daily operations. Management of unforeseen problems and situations within operations steals time away from that which might be spent on NEWVERN development.

Need for Improved Management Reporting

Many of the NEWVERN reports cannot be viewed on the screen; they must be printed. Available reporting capabilities are cumbersome and slow for A.I.D. program managers. They thus rely on frequent telephone inquiries to JSI for information available within NEWVERN and also on voluminous paper reports. Much of the data stored within NEWVERN is not readily accessible to A.I.D. managers.

Need to Increase User-Friendliness

NEWVERN was originally developed to be used in-house by the contractor. It, therefore, was not developed to be an "elegant," fully documented, user-friendly product for installation at other sites. In order to expand NEWVERN's usefulness to non-JSI employees and to reduce training requirements, certain design features need to be improved and more on-line documentation needs to be added.

Need to Improve Financial Accountability

Although NEWVERN is not an accounting system, it does contain funding sources and expenditures. At present, NEWVERN financial data cannot be used universally with assurance. NEWVERN account balances and inventory need to be reconciled with those maintained by USAID missions and by the A.I.D. Office of Financial Management.

A weakness of A.I.D. procedures, reflected in NEWVERN, is the poor performance by USAID missions in acknowledging receipt of shipments. Although JSI is responsible for tracking receipt of shipments, it does not have the authority to force mission compliance. This places JSI in the untenable position of assuming shipments have been received based on the fact that they were sent. This failure to verify the receipt of shipments leaves the A.I.D. contraceptive procurement program open to abuse and misappropriation of shipments.

In addition, A.I.D. could make greater use of NEWVERN financial data; for example, information contained in NEWVERN could be used to facilitate and simplify the payment approval process for the Office of Financial Management. Further, now that NEWVERN has been in existence for over three years and basic CCM functions are automated, its user base could be expanded so that managers outside JSI operations could take advantage of information stored within NEWVERN. More and better on-line reporting capabilities would allow for greater utilization of NEWVERN as a management tool.

Need to Reduce Vulnerability through Documentation

JSI has developed documentation which includes two user's manuals and one technical manual. Although the technical manual is well written and useful, additional technical documentation would reduce the reliance of A.I.D. on the contractor in the event that the contract is not renewed in the future or there is turnover of key employees within JSI.

Summary Recommendations

- 1. A.I.D. should exercise closer management over NEWVERN development** by creating a full-time manager/analyst position within A.I.D. to manage the management information system (MIS) aspects of the FPLM contract.
- 2. A.I.D. should conduct software validation testing** of NEWVERN to identify weaknesses, problems, and areas for enhancements.
- 3. Software trouble reports (STR) and engineering change proposals (ECP) should be used** to identify software problems and requests for software changes or enhancements. These should be written down and clarified by an analyst in precise technical detail. These documents should serve as the essential organizing tool for scheduling, prioritizing, and estimating costs for software modifications. Additionally, STRs and ECPs provide a tool for measuring contractor performance.
- 4. A.I.D. and JSI should adhere to schedules for version releases.** Both should make written contractual commitments describing the content and scheduled completion dates of periodic software releases. Both organizations should work according to long-range plans and schedules and refrain from requesting and responding to unscheduled rush jobs.
- 5. Paperwork and work redundancy should be reduced by automating the CPSD review and approval processes.** For this to occur, better on-line reporting which allows managers to monitor work and respond to exception reports is required.
- 6. Management reporting should be improved.** NEWVERN information should be made available to a wider range of users, including A.I.D. Office of Financial Management and CPSD program managers, through more and better on-line reports.
- 7. User-friendliness and on-line documentation of NEWVERN should be improved** to increase its usefulness and decrease training and support requirements.
- 8. NEWVERN's financial accountability should be improved.** NEWVERN account balances and inventory should be reconciled with those maintained by USAID missions and by the A.I.D. Office of Financial Management. Information contained in NEWVERN should be used to facilitate and simplify the payment approval process for the Office of Financial Management. A.I.D. should strengthen the process of arrival acknowledgment and follow-up of commodities shipped to field recipients.
- 9. A.I.D.'s vulnerability should be reduced through additional technical documentation** so that other analysts and programmers can work with NEWVERN.

1. Introduction

1.1 Project Background

1.1.1 Management of Contraceptive Commodities

The Family Planning Logistics Management (FPLM) Project, implemented through a contract between John Snow, Inc. (JSI) and the U.S. Agency for International Development (A.I.D.), provides assistance to A.I.D. and host country organizations in carrying out the task of managing the purchase and delivery of contraceptive commodities provided to developing countries worldwide. The contract is managed by A.I.D.'s Commodities and Program Support Division (CPSD) in the Office of Population. Currently, the Office of Population provides contraceptives to approximately 70 countries.

Central commodities management (CCM) includes the processes of forecasting and estimating contraceptive needs, processing orders from USAID missions and Cooperating Agencies (CA), scheduling production with manufacturers, tracking funding sources, and distributing commodities to recipients worldwide. The FPLM I contract included the CCM function as one of JSI's responsibilities. JSI began implementation of the FPLM I contract on October 1, 1986. One of JSI's first efforts related to central procurement was to undertake an analysis of the existing system. That analysis, published in draft form in June 1987, revealed a complex manual system which could benefit greatly from automation, especially in light of the staffing constraints under which CPSD was operating. Specifically, the CPSD employee (named Vern) who had for years managed the commodities procurement process retired from A.I.D. The growing magnitude of this program, coupled with the departure of this key CPSD employee, was the impetus for the development of an automated computer system for logistical and financial management. The system was named NEWVERN.

1.1.2 Development of NEWVERN

The original development of NEWVERN was not specified as a deliverable in the FPLM I contract between JSI and A.I.D. Rather, it was developed in-house by JSI as a tool to help JSI manage the requirements of the FPLM I contract. In June 1987, A.I.D. asked JSI to assume responsibility for automating and operating as much of the central procurement system as possible. Work on this system (NEWVERN) began in the fall of 1987.

NEWVERN became operational on October 1, 1988. Following CPSD's instruction, JSI staff have been the primary users (operators) of the system as well as its developers.¹ Consequently, A.I.D. has offered minimal direction and exercised minimal oversight of JSI's software development and maintenance activities. JSI, on its part, has focused attention on developing a computerized system to be used in-house by JSI employees, some of whom are computer programmers. As such, attention

¹JSI minutes dated April 20, 1988, from a meeting with CPSD state "We [JSI] requested guidance regarding the longer-term issue of who will run the system once it becomes operational. . . . [The Office of Population deputy director] stated that it is . . . [the Office of Population director's] intent that as much of the day to day operations as possible be transferred to FPLM; . . . [the chief of CPSD, Office of Population] pointed out that final decision authority must remain with CPSD."

has been focused on programming functionality as quickly as possible into NEWVERN rather than on making it "elegant" and "user-friendly" for users outside JSI.²

The services and deliverables specified in the FPLM II contract and in JSI's workplan focus on describing JSI staff operations pertaining to commodities procurement requirements. These operations include order processing, contracting, estimating, and shipping. Functions related to management information systems (MIS), i.e., the development and maintenance of software, include systems analysis, design review, programming, system administration, configuration management, quality assurance, version releases, and documentation. There is little specificity in either the FPLM II contract or the workplan regarding JSI's responsibilities in these MIS areas.

1.1.3 Response to 1989 Inspector General's Audit of A.I.D.'s Contraceptive Procurement Program

An audit of A.I.D.'s contraceptive procurement program by the Office of the Inspector General in 1989 made a number of recommendations which directly or indirectly affected the environment in which NEWVERN operates. The NEWVERN information system has not only made it possible for A.I.D. to implement many of the audit's recommendations, but has also provided the framework for A.I.D.'s plan for resolving many of the problems identified by the audit.

Recommendation 2 of the audit, recommended, among other things, that the Bureau for Research and Development, Office of Population (R&D/POP) take the lead role in developing effective procedures to control requirements estimates; contraceptive procurement, as to sizes, varieties, and colors; and transportation, warehousing, and distribution of commodities. NEWVERN tracks contraceptives in a variety of ways — by product (size, color, type), destination, production, and availability, thus providing the kind of trend data necessary to analyze the quantities and types of commodities needed for future procurement. In addition, NEWVERN includes up-to-date product registration information and ensures that each order meets certain criteria before shipment is scheduled.

Recommendation 3 recommended that A.I.D. change its procurement function from the General Services Administration to the A.I.D. Office of Procurement. That change went into effect in fiscal year 1990. Although the change streamlined the procurement process and provided A.I.D. with better control of this function, it did not require a major change in JSI's procedures for the automated preparation of monthly production memoranda to the various contraceptive manufacturers.

Approximately 10 contracts for contraceptives are awarded annually by A.I.D. to manufacturers. In 1991, A.I.D. awarded contracts valued at \$58 million. Fulfillment of these annual contracts is done on a monthly basis, thus allowing manufacturers to schedule continuous production and pass substantial savings along to the government. JSI sends a monthly production memorandum to each manufacturer describing the precise types and quantities of contraceptives to be produced, the type of film to be used for packaging condoms, and where to ship the orders. The calculation and printing of these production memoranda is automated by NEWVERN. Matrix International Logistics, Inc.

²The NEWVERN user's manual written by JSI states, "The complexity [of NEWVERN] is not a design feature, but rather an inevitable consequence of the complex and inefficient procurement system which NEWVERN is forced to model; success at modeling this complex system has come at the expense of the elegance and robustness which are the goals of any system designer. It is hoped that the procurement system will become simpler over time."

(Matrix), under a contract with A.I.D., works closely with JSI and handles the receipt of shipments from manufacturers, warehousing, and shipping to recipients.

GSA also no longer handles warehousing or shipping. An evaluation of the Matrix contract, completed in September 1991, reported improved management of warehousing and shipping. In 1991, JSI tracked 424 payment vouchers from Matrix, representing 925 shipments and 520 orders from USAID missions. These data are stored in NEWVERN and the work is handled by JSI and Matrix.

Recommendation 4 recommended that A.I.D. develop and implement an improved funding mechanism for contraceptive commodities that is consistent with a centralized procurement activity. As with the change in the procurement function from GSA to A.I.D., the flexibility programmed into NEWVERN made it possible for the system to develop efficient mechanisms for transferring funds from USAID and A.I.D./Washington office budgets to R&D/POP for centralized procurement of contraceptives.

In June 1990, a new centralized A.I.D. project — Central Contraceptive Procurement (936-3057) — was created to accept funds transferred for central procurement of contraceptive commodities. USAID missions and R&D/POP make operational year budget (OYB) transfers of unobligated current year funds to this project. A.I.D., through its FPLM contract with JSI and its participating agency service agreement (PASA) with the Centers for Disease Control (CDC), develops contraceptive procurement tables (CPT) with each country for the purposes of estimating future contraceptive needs. These CPTs are then used by A.I.D. to consolidate annual contraceptive requirements and award contracts to manufacturers.

JSI sends out a quarterly statement to each mission, informing it of orders shipped and its account balance. When a mission's order exceeds its account balance in the centralized fund, the order is not filled and the mission is notified that it does not have enough funds available to fill its request. This "pay-in-advance" policy prevents cost overruns for contraceptives by individual missions.

Currently, A.I.D. purchases condoms at about 5 cents each and a one-month cycle of oral contraceptives at about 15 cents each. These costs compare with U.S. retail costs of \$.75 to \$1.50 per condom and \$15 to \$20 per cycle of oral contraceptives. In 1991, over 1 billion units of contraceptives were ordered from manufacturers.

1.2 Purpose of the NEWVERN Evaluation

A.I.D. recognizes that most of the critical data involving contraceptive production, ordering, funding, billing, shipping, and estimating are stored in NEWVERN. NEWVERN is essential to the management of the FPLM program. Because of this, A.I.D. initiated this evaluation to examine NEWVERN's capabilities and to recommend to A.I.D. managers ways in which the system's outputs, management, and operation could be improved. Many of the recommendations in this report describe standard processes in managing an MIS environment.

Previous evaluations³ have made recommendations which have an impact on NEWVERN, but no evaluation has specifically examined NEWVERN itself. One purpose of this evaluation was to examine the structure of the NEWVERN software from a design and computer programming perspective. Questions were technical: Is the software reliable? Is it dependable? Is it user-friendly? The other purpose of the evaluation was to examine the implementation of the software from an A.I.D. program perspective. How vulnerable is A.I.D. to an outside contractor controlling NEWVERN? Does the software provide financial accountability? Is it used as a management tool for procurement and planning? Has NEWVERN been appropriately and adequately implemented? How can A.I.D. improve control over and use of NEWVERN? What future development should be planned for NEWVERN? What management practices should be modified or implemented?

1.3 Evaluation Methodology

The evaluation was carried out by a three-person team. The team leader, Amy Beam, Ed.D., focused on examining the design and reliability of the NEWVERN software as well as management issues. Betty Case examined FPLM contractual documents and also the usefulness of NEWVERN information to various types of users. Douglas Robbins examined the NEWVERN system from a financial perspective with a special interest in accountability. (See Appendix A for information on the backgrounds of team members.)

The team leader interviewed JSI staff and examined their procedures; the other team members interviewed A.I.D. personnel and examined their procedures and use of NEWVERN reports. Team members individually arrived at the same findings and formulated the same major recommendations. Some of their major findings and recommendations are the same as those identified by previous evaluations.

The evaluation team undertook the following tasks:

- Interviewed 27 persons (see Appendix A);
- Sent questionnaires to 17 USAID missions (see Appendix C);
- Examined over 25 documents (see Appendix A);
- Examined NEWVERN technical and user's manuals;
- Examined NEWVERN reports;
- Examined NEWVERN software screens; and
- Examined NEWVERN source code.

The evaluation focused on two broad areas: management issues and software issues. The following management issues were examined:

- 1989 Inspector General Audit recommendations
- FPLM contract management
- Accountability

³Midterm Evaluation of Family Planning Logistics Management Project, May 19, 1989, POPTECH; An Overview of the Centrally Funded Contraceptive Procurement Project No. 936-3018, Audit Report No. 9-000-89-010, September 29, 1989, Inspector General's Office of Programs and Systems Audits; Evaluation of the Central Contraceptive Procurement Project (936-3018) Matrix International Logistics, Inc., September 27, 1991, POPTECH.

- Reliability
- Staffing
- Job redundancy
- Communications
- Definition of users
- Use of NEWVERN by A.I.D.
- Use of NEWVERN reports
- Approval processes
- Paperwork flow
- Level of automation
- Implementation
- Training
- Data entry
- Accounting
- Legal requirements

The following software issues were examined:

- Functionality
- Software problems (bugs)
- Maintenance procedures
- Design review process
- Design features for users
- Technical design features
- File structure
- Data integrity
- Security
- Programming standards
- Configuration management
- Quality assurance
- System administration
- Technical documentation
- User documentation

JSI's performance related to NEWVERN software development was evaluated using the concept of "life cycle development." Software development progresses through stages which collectively are referred to as life cycle development. The stages include the following:

- Functional requirements analysis
- Hardware and software selection
- Development of technical design specifications
- Programming
- Alpha and beta testing
- Installation
- Documentation
- Software validation testing
- Training
- Implementation
- User support

- Version releases (enhancements and fixes)
- Expanded user base

The evaluation sought to identify and describe how far JSI had progressed in the life cycle development of NEWVERN. Much of Section 4 of this report focuses on recommendations for those development stages which have not been fully implemented. These stages include documentation, testing, training, user support, version releases and enhancements for an expanded user base. Lack of completion of all of the development stages should not be used to measure performance. JSI has managed the software development in a normal, responsible manner which reflects industry standards for software development. The fact that there are outstanding tasks to be accomplished and procedures to be implemented is not intended to reflect any lack of responsiveness or capability on the part of JSI.

Because of the number and complexity of issues to be evaluated, the evaluation team could not devote the time it desired to analyze and evaluate thoroughly all aspects of NEWVERN. Those issues which were examined are discussed in this report. No inferences should be drawn, either negative or positive, regarding issues the report does not address.

1.4 Clarification of Key Concepts and Issues

The following key concepts and issues are examined throughout this report.

1.4.1 Accountability

Can it be determined how the money was spent? Can all money and commodities be *accounted for*? Which people are or should be held accountable for the operation of NEWVERN?

1.4.2 Reliability

Are the data in NEWVERN accurate? Are they entered accurately? Processed accurately? Reported accurately?

1.4.3 Dependability

Can A.I.D. depend on the continuing operation and availability of the NEWVERN system? Will the software and hardware continue to function? Will PROGRESS programmers be available? Will the operating system and programming language continue to be available and supported? Is there adequate security to ensure NEWVERN's dependability? Can the NEWVERN software be supported in case something happens to the current programmer or contractor?

1.4.4 User-Friendliness

This term describes software that can be operated by non-technical users with little training and little assistance. User-friendly software should provide sufficient error messages, help messages, and on-line documentation. Stored data should be readily accessible to users, especially managers, for purposes of analysis, accountability, management, and planning.

1.4.5 Life Cycle Development

As noted in Section 1.3, life cycle development of software moves through stages that include requirements analysis, systems analysis, hardware and software selection, software design, programming, testing, documentation, installation, training, implementation, user support, maintenance, and enhancements. In a computer environment, software development is seldom "finished" because users continue to identify new areas for automation. It is an ongoing process that requires certain management procedures unique to a technical environment.

1.4.6 Software Maintenance versus Operations

Although previous A.I.D. references to NEWVERN have used the terms *maintenance* and *operations* interchangeably, the terms are not synonymous. Each represents a distinctly different function as used in this report. In a computer environment, *maintenance* refers to the job of keeping software running. It includes making changes to the source code, correcting erroneous data that users are not permitted to correct through the software routines, and keeping the hardware and software operational. Computer programmers perform software maintenance. *Operations* refers to what end-users do when they use the software. Users should be knowledgeable about the program they are responsible for operating. They use the software as a tool, but they do not make changes to the software nor do they require programming knowledge.

1.4.7 Authority versus Responsibility

A.I.D. has given JSI *responsibility* for performing daily operations, but has retained *authority* for approving what work is done. The separation of responsibility from authority poses certain logistical issues, which are discussed in this evaluation.

1.4.8 Job Redundancy

A.I.D. has asked JSI to provide job redundancy under the FPLM contract. *Job* redundancy refers to having more than one person capable of performing the same job function. Job redundancy reduces vulnerability based upon reliance on a single person's knowing how to perform a job function. Job redundancy should not be interpreted to mean that the same work is done more than once by more than one person, which would imply *work* redundancy.

2. Project Management

Previous Page Blank

2. Project Management

2.1 Authority and Responsibility of A.I.D. and JSI

Under the FPLM contract, JSI is not only to develop and maintain NEWVERN, but is also to perform as much of the daily operations as possible to support the FPLM program. Thus, JSI is the primary user of NEWVERN. The contractual agreement between JSI and A.I.D. has resulted in the automation of JSI operations, but not the CPSD approval function. (It should be stressed that JSI has delivered upon its contractual obligation.) The discussion which follows concerns order processing, but the issues involving the CPSD approval process apply to all of the tasks performed by JSI.

JSI staff enter data, oversee order fulfillment, and produce hard copy reports for CPSD and USAID mission staff to review. JSI has been given responsibility to perform the daily work, but has not been given authority to approve or disapprove which work is done, specifically which orders are filled or modified. Consequently, a considerable amount of paper is shuttled back and forth between JSI and CPSD offices, twice a day. An order from a USAID mission is sent via cable to A.I.D. An A.I.D. employee reviews the order and "approves" it by copying the order onto another form, attaching the form to the cable, and sending it to JSI for entry into NEWVERN. The A.I.D. review consists of checking the order for many required conditions, such as whether the requested contraceptive commodity is registered in the country making the request. Other issues which A.I.D. reviews are more subjective, such as determining whether to pay for donated contraceptives with CPSD funds or whether to ship requested commodities prior to funds being available. Many of the rules which govern the order approval process are automated in NEWVERN and invoked as edit checks during the order entry process. Yet, when the A.I.D. employee reviews an order and approves it, he or she does not use the computer. Thus, A.I.D. does the approval process manually, then JSI does it on the computer. If the rules for order entry are automated within NEWVERN, there should be no reason for A.I.D. to do the approval process manually.

This separation of *responsibility* from *authority* has created excessive paperwork, work redundancy, and a one- to two-week time lag in updating computer records, which causes even more work. As the current procedures exist, *both* CPSD and JSI staff process each order twice: once when it is received and once for final approval after data entry. Why, for example, should an A.I.D. employee have to check a file to verify that an ordered product is registered in the country that ordered it when NEWVERN will do this same check automatically?

JSI could provide A.I.D. with on-line or paper reports for managers to review after data entry occurs. In this way, A.I.D. could monitor JSI operations without being burdened with unnecessary manual review and approval processes. On-line reports could be made available to CPSD staff so they could review, on a daily basis, all orders, especially any orders that were modified by JSI. If CPSD staff want to change the decisions made by JSI staff during order processing, they could call them on the phone and tell them to or modify records themselves within NEWVERN.

Hundreds of rules for handling work are programmed into NEWVERN. By approving each rule, CPSD has appropriately exercised its oversight responsibility. It is, therefore, not necessary for CPSD to approve each and every application of a rule. CPSD should only have to approve exceptions to the rules provided by CPSD and programmed into NEWVERN. CPSD could define for JSI all

exceptions to standard daily operations of which it wants to be informed. As an additional effort to streamlining work, fewer exceptions to the rules should be accepted from missions placing orders.

Alternatively, CPSD staff could be given permission, on a restricted basis, to modify records directly in the computer. In many other automated procurement systems, orders are entered by a procurement specialist with approval authority. When an order is created or modified, the log-in identification of the procurement specialist is automatically posted by the computer to the record, along with the date. No data entry is required to identify who gave approval.

A computer system can grant or deny permission to certain users to enter or modify orders for certain customers (countries, etc.). Thus, the approval process is built into the software security system. No order can be created or modified by any person not having permission. This permission system is currently programmed into NEWVERN, but permission to conduct data entry is restricted to JSI staff. (See Section 4.1.5.4 on the NEWVERN permission system.)

Recommendations⁴

1. The CPSD administrative review and approval process should be automated to reduce paperwork and work redundancy.
2. The rules programmed within NEWVERN should be relied upon as part of the approval process. Also, better on-line reports, including exception reports, can help to achieve automation.

2.2 Staffing

2.2.1 Staffing within JSI

JSI has handled the development of NEWVERN in a responsible and cost-effective manner. The NEWVERN system was developed within JSI primarily by one individual, who performed the original systems analysis, software design, programming, testing, training of users, and writing of both the technical and the user's manuals. As the manager of the contraceptive commodities management (CCM) portion of the FPLM contract, he continues to support daily operations as well as managing all new software development. The amount of work that has been performed by a single person is a considerable achievement. It is not unusual for similar projects to be staffed with 5 or 10 people to accomplish the same amount of software development.

Currently, seven people at JSI work on the CCM/NEWVERN portion of the FPLM contract. Three people do software development and maintenance (programming) and four people do daily operations (see Section 1.4.6). When the persons performing operations need assistance, they rely on the programmers — primarily on the CCM manager. When the functions of operations and development are combined under the same umbrella, operations *always* takes precedence, thus constantly stealing time away from development efforts and disrupting development schedules for software version releases. Work that must be done *now* always has priority over work that can be done *later*.

⁴Recommendations are numbered consecutively throughout the report and are collected together as Appendix E.

So long as the CCM manager is actively involved in managing daily operations, his time spent on software development — analysis, meeting with CPSD, design, programming, testing, documentation — will be less than full-time. Since the opportunity exists for CPSD to take much greater advantage of data contained within NEWVERN, it would be best for JSI NEWVERN programming staff to devote full-time effort to software development and remove themselves from daily operations. For this to occur, A.I.D. and JSI would have to distinguish between development effort and operations effort when allocating resources under the FPLM contract. The development effort would then have to be more closely managed. (See Section 4.1.2.)

This evaluation did not permit sufficient time for an analysis of the issue of whether JSI has too few, too many, or just the right number of staff assigned to NEWVERN operations. Analysis of the database shows that 10 contracts with manufacturers, 520 orders from missions and CAs, 424 payment vouchers from Matrix, and 1,819 total transactions were handled by JSI in 1991. The addition of more on-line management reports that track the amount of work done could help to determine what an appropriate staffing level would be for NEWVERN operations.

JSI is extremely responsive to A.I.D. requests. JSI staff are always willing to put aside other work in progress and even work overtime to respond rapidly to A.I.D. requests for new reports, information, or assistance to USAID missions. Paradoxically, JSI's extreme responsiveness to A.I.D. requests may in the long run be counter-productive. Constantly working in a reactive mode disrupts the ability to perform long-range planning and schedule staff efficiently.

Recommendations

3. A clearer distinction should be made within JSI between staff resources allocated to operations and staff resources allocated to software development and maintenance. JSI NEWVERN programming staff should devote full-time effort to software development and remove themselves from daily operations.
4. Both A.I.D. and JSI should treat fewer requests as crises and strive toward a software development environment which prioritizes requests and implements them through scheduled software releases.

2.2.2 Staffing within CPSD

The A.I.D. cognizant technical officer (CTO) for the FPLM contract with JSI has numerous roles, including deputy chief of CPSD, country/regional specialist for the Asia/Near East region, overall logistics management, forecasting, donor coordination, and CTO for the Centers for Disease Control PASA. This leaves little time for management of the critical NEWVERN component of the FPLM project.

The other CPSD staff are organized by regional/product/subject responsibilities. Regions of responsibility are Latin America and the Caribbean, Asia/Near East, and Western and Eastern Africa. Products are condoms, oral contraceptives, IUDs, vaginal foaming tablets (VFT), and Norplant. Subjects of responsibility are quality assurance, shipping/warehousing, funding, and AIDS. As a result, everyone is involved with NEWVERN at some time. The allocation of responsibilities appears to be in balance. There are periodic and ad hoc meetings of the staff to discuss issues or solve problems that cut across lines of responsibility.

Neither the CTO nor other staff has sufficient time left over to devote to reviewing report content, identifying actual and potential problems, or developing recommendations for improvements. Everyone is too busy processing daily actions and reacting to unforeseen issues to devote time to managing NEWVERN.

No one on the CPSD staff currently has the technical skills to advise A.I.D. on automation-related issues as well as program issues. Such a person is needed to carry out the recommendations made in this report. At the outset of this evaluation, no such position existed within CPSD. As this report was being completed, a position with primary technical responsibility for NEWVERN had been created and filled by a lateral transfer within R&D/POP. This person will be the main liaison with JSI regarding NEWVERN software development and maintenance.

Recommendation

5. A position should be established within CPSD to manage the software development and maintenance of NEWVERN and other MIS components of the FPLM contract. The person selected for this position should identify and articulate to JSI what is needed by A.I.D. Also, this person must have enough technical expertise to understand those changes or enhancements recommended by JSI and other contractors.

2.3 Contractual Deliverables for NEWVERN

According to the FPLM II contract, JSI is required to submit the following four reports to A.I.D.: an annual workplan, semi-annual progress reports, semi-annual level of effort reports, and quarterly expenditure reports. These reports reflect the primary focus of the FPLM project: technical assistance to the field in logistics management. Information in the reports with regard to NEWVERN is not very informative, and it is difficult to relate level of effort to expenditures. Reports are submitted to the CTO, but the CTO has little time to become involved in analyzing the reports and monitoring NEWVERN activities at the level of technical detail necessary.

JSI has developed a two-page annual workplan for NEWVERN for 1992. Because the workplan has not quantified or detailed individual tasks, and because no completion dates are included, it cannot be used by A.I.D. to measure completion of tasks by JSI. (This workplan, along with recommendations for improvements, is described in Section 4.1.2.3.)

The semi-annual progress report provides a brief summary of the accomplishments of JSI, e.g., "implemented major revision of NEWVERN"; "continued to operate the system without interruption"; "developed and implemented a redundancy strategy"; "responded to requests." Where schedules and dates are concerned, the terms "ongoing" and "on-schedule" are used. "Ongoing" is an inappropriate term to use to measure deliverables. Specific tasks with definite dates need to be indicated by JSI and their completion monitored by A.I.D.

The quarterly expenditure reports provide level of effort in one part and expenditures in another, using different categories. It is difficult to determine if the reports reflect what was requested by CPSD or what JSI assumed was required, for lack of clear guidance.

Recommendations

6. A.I.D. should clarify and increase the level of detail needed for JSI contractual reports to be useful. Clearer reports should relate level of effort to tasks completed.
7. With regard to NEWVERN development (not operations), A.I.D. should require JSI to submit in writing, for approval, a list with detailed descriptions of modifications and enhancements to be made to NEWVERN with quarterly completion dates. (See Section 4.1.2.1.)
8. The precise contents of each software release should be tested when work is completed (see Section 4.1.2.2 for recommended format). Written documentation should accompany each software release and should be considered a contractual deliverable.

2.4 Allocation of Time and Resources

The FPLM contract requires JSI to develop and monitor CPTs for A.I.D.-supported programs and to maintain and enhance both the NEWVERN and Population Projects Database (PPD) management information systems. The contract is unclear on the estimated amount of time JSI should devote to NEWVERN. The contract anticipates that 413 person months of effort will be required for the above three activities over the life of the contract. It is impossible to determine from the contract how these person months should be allocated to the three management information systems (CPT, NEWVERN, and PPD).

A potential conflict is inherent in the manner in which the contract is written. NEWVERN is managed in CPSD, but the PPD system is managed in a different R&D/POP division. These two systems, managed within A.I.D. by two different persons within two different divisions, compete for the same JSI resources. This puts JSI in the difficult position of trying to respond with limited resources to two separate offices.

Recommendation

9. The estimated amount of time that JSI should devote to NEWVERN and to PPD should be stated in the FPLM contract. A.I.D. should establish an internal procedure for resolving conflicts resulting from competing demands for limited JSI resources.

2.5 PROGRESS Programmers

PROGRESS is the language in which the NEWVERN application is programmed. PROGRESS has been on the market since 1983 and currently runs on several hundred computer platforms (see Appendix F for growth rates). Information obtained from PROGRESS Corporation indicates that there are some 500,000 PROGRESS users and 1,000 value-added resellers who sell PROGRESS. There are 100,000 PROGRESS licenses worldwide. Each license usually supports multiple users. The number of PROGRESS programmers in the United States may be between 2,500 and 10,000.

PROGRESS Corporation's quarterly magazine, *Profiles*, is distributed to 10,000 readers, primarily PROGRESS developers. This distribution level provides a good estimate of the number of PROGRESS programmers.

PROGRESS has a 5 to 10 percent market share of all fourth-generation languages. It competes against other popular fourth-generation languages, including Unify, Oracle, Ingress, and Informix. PROGRESS has been benchmarked (tested) by industry experts and ranked as the leading fourth-generation language running on UNIX. Although PROGRESS may be the best language technically, its small market share presents other problems. Because PROGRESS continues to enjoy rapid growth worldwide, there continues to be an under-supply of PROGRESS programmers. The Information Resource Management office of A.I.D. does not have in-house PROGRESS expertise necessary to test or support NEWVERN. Companies wishing to use PROGRESS typically find that they must train a programmer to use PROGRESS. PROGRESS Corporation and other third-party companies offer one-week PROGRESS training classes.

Washington, D.C., is one of the largest market areas for PROGRESS. A junior programmer with one or two years of PROGRESS experience is paid between \$30,000 and \$40,000. A senior analyst with three or more years of PROGRESS experience is paid \$50,000 and up. More likely, senior PROGRESS analyst/programmers work on a consulting basis at hourly rates of \$65 to \$100. PROGRESS Corporation charges \$1,500 per day for consulting, with package rates available.

Because PROGRESS is easy to learn, junior or neophyte programmers can quickly program in PROGRESS. The drawback is that they may have little or no understanding of how properly to design a relational database or to change code in existing software. Even though PROGRESS is easy to learn, learning the language does not turn a programmer into an analyst and designer. Staffing a software development effort solely with junior people typically results in poor software design, which at a later point, results in maintenance costs that are 5 or 10 times more expensive than the original development.

To guard against over-reliance upon one or two key people who understand PROGRESS, JSI has about five other applications also developed in PROGRESS. Currently, only two PROGRESS programmers work on NEWVERN, but one new junior person is being trained. In anticipation of the eventual career progression of the individual who developed NEWVERN, JSI needs to hire or groom a senior analyst and PROGRESS programmer. A junior programmer, regardless of PROGRESS knowledge, cannot be expected to assume a lead position in managing modifications and enhancements to NEWVERN. Two junior programmers are not the equivalent of one senior programmer/analyst; there is no substitute for having a senior-level programmer/analyst.

The FPLM II contract stipulates that JSI should work with CDC to duplicate JSI's capability to operate and enhance NEWVERN. It is not clear what the benefit of such an arrangement would be. Configuration management requires that software be developed in one central location under one manager so that diverging versions are not developed (see Section 4.2 on configuration management). CDC staff should be viewed as users, not software developers. As users, their interest would be limited to retrieving data through NEWVERN reports. In any event, an employee of CDC should not become involved as a PROGRESS programmer in changing NEWVERN code unless such a person works on-site at JSI. In addition, since CDC is not contractually responsible for daily operations, such as order processing, there is no need for a CDC employee to learn how to operate NEWVERN. The development of more and better technical documentation of NEWVERN would be the appropriate way in which to reduce A.I.D. vulnerability based on reliance on a sole contractor.

Recommendation

10. JSI should seek to hire or groom a senior analyst and PROGRESS programmer. A.I.D. should recognize that the cost of such a technical specialist will be the same as that of a mid-level manager.

3. Implementation of NEWVERN

Previous Page Blank

3. Implementation of NEWVERN

3.1 NEWVERN Functionality

In 1991, NEWVERN kept track of the following FPLM data:

Countries (some inactive)	164
Customers (some inactive)	88
Recipients (some inactive)	300
Contracts with manufacturers	10
Total amount of contracts	\$58,164,478
Contract unit quantity	1,043,509,600
Mission and CA orders	520
Total contraceptive units shipped	1,549,859,010
Number of shipments	925
Shipping costs	\$4,290,807
Number of Matrix vouchers submitted	424
Number of transactions posted	1,819
CPTs	362

The NEWVERN user's manual and the technical documentation describe in detail the current functionality programmed into NEWVERN. The main features are described here.

3.1.1 Procurement

NEWVERN has automated the following centralized procurement function:

Contract production memos are computer-generated each month to ensure that contractually mandated product, item, and funding mixes are adhered to. These memos are sent to manufacturers with instructions to produce and ship specified commodities in 12 equal monthly installments. CPSD staff are no longer required to check each memo for correct billing and ordering information, to verify that production orders remain within the brand and volume limits specified in contracts, nor to verify stock levels at warehouses.

3.1.2 Order Fulfillment

Order fulfillment includes handling customer orders, warehousing stock when necessary, and shipping to recipients. NEWVERN has automated the following features and functions:

Scheduling of orders from USAID missions and CAs ensures that orders are filled within one month of the requested receipt date. NEWVERN prevents the acceptance of orders that cannot be met. Both warehouse resources and production by manufacturers under contract are used to fill orders as needed.

Tracking of all stock in warehouses used by CPSD ensures use of first-in-first-out rules for filling shipments, thus preventing pools of aging products from building up in warehouses and eliminating the need to track stock levels by hand.

Warehouse shipping memos generated by NEWVERN have eliminated the need for CPSD staff to type individual shipping instructions for each shipment.

Monthly shipping notification is made to USAID missions identifying the status of all shipments in transit to mission-supported programs and providing as many details of arrival as are known. Missions are requested to acknowledge receipt of shipments and that acknowledgment is then entered into NEWVERN. The ability to track the acknowledgment of receipt of shipments is programmed into NEWVERN, but the policy of acknowledging receipt is poorly implemented by A.I.D. (See Section 3.2.5.)

Shipment tracking information is available on-line and includes current locations of shipments, estimated arrival date, carrier, and vessel number or flight name.

Electronic data transfers between the NEWVERN database and the database kept by Matrix increase efficiency and the ability to provide up-to-date information.

3.1.3 Funding

Although NEWVERN is not an accounting system, it does keep track of funding sources and expenditures, as follows:

OYB transfers and funded PIO/Cs (project implementation order/commodity) from USAID missions and from R&D/POP for CAs are placed into a centralized fund which is used to procure commodities through consolidated annual contracts. This replaces voluminous paper records kept in the past.

An up-to-date balance for each USAID mission is available on-line, reflecting all funds submitted and all shipments requested by that mission, permitting CPSD to determine the status of each mission's account and to identify those missions that need to provide funds to CPSD to cover existing orders.

A quarterly statement of contraceptive account is sent to each mission. This identifies the cost of each transaction during the quarter, including shipping costs, and provides a balance of unused funds. Each order received from a mission is assigned to be filled under a current contract with a manufacturer, where possible. The unit price of each commodity shipped to a mission is determined by the unit price negotiated in the contract with the manufacturer. In actuality, orders may be filled from existing stock in a warehouse, but the cost to the mission for the order is initially calculated based on the current estimate of the manufacturing cost of the product at the time of shipment. In the event that orders are filled from warehouse stock, the charges to the mission are updated to reflect the actual cost of the commodities provided.

A pay-in-advance policy is implemented through NEWVERN checks which prevent missions from ordering product worth more than their total unused funds without prior CPSD approval.

3.2 NEWVERN Accountability

NEWVERN is a logistics management information system which uses financial and other data to track commodity orders and deliveries against funding available for that purpose. Although NEWVERN is not part of A.I.D.'s official accounting system, the "notational accounts" maintained by NEWVERN supplement A.I.D.'s accounting records.

Management objectives for use of NEWVERN data include the following: (1) to monitor funds by contributing source, (2) to provide expenditure data by country and by program, (3) to facilitate administrative approval of payments due to manufacturers, (4) to verify independently warehouse inventory levels physically controlled by A.I.D./Washington's freight forwarding contractor, Matrix, and (5) to follow up on delivery to customers worldwide to ensure receipt.

3.2.1 Country Reconciliation

NEWVERN funds currently flow from the following sources: funded PIO/Cs submitted by USAIDs, budget allowance transfers (BAT), and OYB transfers from USAID mission and CPSD budget allocations. Accounting responsibility remains with the missions for funded PIO/Cs and BATs, but lies with A.I.D./Washington's Office of Financial Management for mission and regional bureau OYB transfers and Central Contraceptive Procurement project allocations. Control over the obligation of all these funds lies with R&D/POP/CPSD (although some PIO/Cs have been obligated before they have been received by CPSD).

Upon receipt of an approved program revision request, CPSD distributes the total available funds to the ordering organizations and notifies JSI of these levels for input into NEWVERN. No fund availability data for OYB transfers can be entered into NEWVERN by JSI, or changed, without a signed CPSD allotment transfer approval form. This document is CPSD's authorization for NEWVERN to consider these funds available for commodity orders. For funded PIO/Cs, the PIO/C is the authorizing document for entering data into NEWVERN.

Ideally, NEWVERN should only include or track financing provided by OYB transfers to the Central Contraceptive Procurement project. Due to various factors outside the control of CPSD, however, this is not the case and missions continue to submit funded PIO/Cs. The country expenditure data available in NEWVERN are not being used without manual intervention to factor out those shipments that are charged to these mission-funded PIO/Cs. Several missions' records do not agree with those of NEWVERN. Attempts made to reconcile major differences have proven difficult. This has had an adverse effect on gaining mission reliance on account balance information contained in the quarterly statement of contraceptive account generated by NEWVERN. This situation must be rectified before NEWVERN financial data can be used universally with assurance.

Recommendation

11. CPSD should complete the process of reconciliation between account balances kept by USAID missions and those kept by NEWVERN.

3.2.2 Expenditures

The estimating and reporting of actual expenditures by project are an integral part of A.I.D.'s financial management system. They are also required by the Office of Management and Budget and

Congress to help support the need for new obligational authority in A.I.D.'s budget presentations. Expenditures can generally be termed "delivery of goods and services." The method used by A.I.D. to compute expenditures is to add to the total payments made for commodities received an accrual for commodities received but not yet paid for.

NEWVERN offers A.I.D. an opportunity to fine-tune and simplify this process because it records all orders received (whether paid for or not) upon delivery from manufacturers to Matrix. Further, NEWVERN records the delivery of commodities to the USAID missions that provided funds, thereby tracking the real resource transfer to the appropriate country. This is why the field acknowledgment of receipt of shipments is essential to close the loop of the ordering/delivery cycle (see Section 3.2.5).

The first attempt to use NEWVERN financial data was for the fiscal year 1993 congressional presentation. This was not successful, however, primarily due to a misunderstanding as to the source within NEWVERN from which the information should have been obtained. Project expenditures must be recorded in A.I.D.'s official accounting records maintained by the Office of Financial Management. In this case, the Office of Financial Management had no knowledge of the information available in NEWVERN when accruals were being developed for year-end expenditure reporting. It is essential that greater coordination be developed between CPSD and the Office of Financial Management to prevent a recurrence of this situation, and to explore other ways of providing management with more timely and reliable financial data with which to manage the population program at all levels of A.I.D.

During this evaluation, action was initiated jointly by CPSD and the Office of Financial Management to prepare quarterly expenditure data for inclusion in A.I.D.'s official accounting records. This type of cooperation could also facilitate periodic examination of unliquidated obligated balances as reflected in A.I.D. accounts — a requirement under Section 1311 of the Anti-Deficiency Act. Improved cooperation between CPSD and the Office of Financial Management should go a long way toward incorporating NEWVERN data into A.I.D.'s mainstream accounting process, thus increasing reliability of data.

Recommendation

12. CPSD should establish an effective working relationship with the Office of Financial Management for development of expenditure information and obligation tracking.

3.2.3 Administrative Approval

CPSD has recently begun to realize a significant increase in the workload of the CTOs for the contraceptive contracts in providing administrative approval of payment documents for commodities ordered under their respective contracts. These requests originate in the Office of Financial Management and are in accordance with A.I.D.'s system of internal control over the payment process. The administrative approval process is simply a means to determine whether A.I.D. received what it is being requested to pay for.

With the advent of OYB transfers, more and more of the payment function has shifted from USAID missions to A.I.D./Washington for population commodities since A.I.D./Washington is the accounting station for the Central Contraceptive Procurement project, under which these transfers are obligated. Drawdown under the old system, in which payments were made primarily by the field accounting

stations, is rapidly being phased out. This has also led to the increased workloads that both the Office of Financial Management and CPSD are experiencing. The problem is exacerbated by a misunderstanding of what was being asked of the CTO in the voucher approval process. The consensus among those giving administrative approval was that the CTO was expected to certify receipt of the commodities in-country. That, however, was not the case. What was needed was a certification that A.I.D. had taken delivery of the commodities from the manufacturer.

A.I.D.'s freight forwarding contractor, Matrix, records all commodity deliveries in its computerized inventory control system. Matrix data are electronically transferred to NEWVERN. It should be simple, therefore, for the CTOs to access NEWVERN on their remote terminals to ascertain whether a particular order has been received under a specific contract and/or production order. The ability to access data rapidly on-line regarding receipt of shipments from manufacturers should also better enable A.I.D. to meet the criteria of the "Prompt Payment Act," thereby avoiding unnecessary penalty interest payments for contraceptive commodities.

Recommendation

13. NEWVERN's on-line capability should be used by CPSD to facilitate administrative approval of payment documents.

3.2.4 Inventory Adjustments

The system of inventory control utilized by Matrix was reviewed and documented during an evaluation that took place in the summer of 1991. The system employed was found to be satisfactory. Additionally, Matrix's accounts are audited by a public accounting firm annually, and the audit document is available for A.I.D. management to review at any time. An interview with Matrix's project supervisor revealed that shortfalls in deliveries do occur sometimes, but they are made up by the manufacturers in short order. Nonetheless, certain inventory adjustments must be made in NEWVERN from time to time. These adjustments are being made jointly by Matrix and JSI staff and do not receive the attention of A.I.D. management. This situation does not meet the test of generally accepted accounting standards. CPSD needs a review and approval process for all inventory adjustments entered into NEWVERN. This approval process could be put on-line, as recommended in Section 2.1.

Recommendation

14. CPSD should implement a review and approval process for all inventory adjustments entered into NEWVERN and should periodically obtain independent verification that the physical inventory in the warehouse is in agreement with NEWVERN records.

3.2.5 Acknowledgment of Receipt

The NEWVERN system utilizes a "two-way" memorandum to communicate delivery information on shipments made to USAID missions. The confirmation of receipt is supposed to be forwarded back to JSI by the missions. Both JSI staff and replies to the field questionnaire used in the evaluation indicate that this process is not working well. This failure to acknowledge receipt of commodities leaves A.I.D.'s contraceptive procurement program open to abuse and misappropriation of commodities.

The receipt process is a very informal process which uses a returned, initialled copy of the memorandum to document receipt/non-receipt of millions of dollars of contraceptive commodities. Additionally, the funding mission that is responsible for acknowledging receipt is not the organization that actually receives the shipments. The shipments go directly to in-country recipients, such as family planning organizations. One respondent to the field survey suggested that the two-way memorandum be sent directly to the recipient instead of to the mission, as is now the case. The recipient would indicate receipt and return the memorandum to JSI through the mission.

JSI has the responsibility to track receipt of shipments, but does not have the authority to enforce A.I.D. requirements for USAID missions to acknowledge receipt of shipments. Therefore, because so many missions fail to acknowledge receipt of shipments, in addition to the two-way memorandum, JSI uses two alternative methods to verify receipt of commodities: (1) receipt of a completed CPT which indicates that shipments recorded by NEWVERN as having been sent have been received (frequently, a visual inventory) and (2) automated notification from the freight forwarder, Matrix, that commodities have been received in the warehouse. JSI states that every shipment record with a status of received has a paper document to verify receipt.

There are several weaknesses in NEWVERN's current design of tracking receipt of shipments. NEWVERN shipment records contain a field for a status code to be entered indicating where the shipment is. A status of "R" means the shipment has been received. If the user enters a receipt date *or* enters a quantity received, the system automatically changes the status to "R" for received. However, NEWVERN allows a user to enter or change the status field directly, and because there is no edit check on this field to guarantee that proper record relations will be maintained, errors can arise. For example, if a user re-enters the same shipment record and deletes the receipt date and quantity received the status is not set back — it remains received. Thirty percent of all shipment records with a status of "R" have no date of receipt. Seventeen shipment records with a status of received have neither a date of receipt nor a quantity received.

Further, two different types of "receipt" are being tracked in only one status field. Commodities can be "received" by the freight forwarder, in which case A.I.D. is obligated to pay the manufacturer for receipt of goods. These "received" commodities may actually be placed in a warehouse prior to being shipped to a recipient. Commodities can also be "received" by a recipient in-country. This "receipt" by a recipient has no bearing on whether A.I.D. is obligated to pay the manufacturer. Receipt by the recipient, however, is necessary to ensure that commodities reach their final destination to maintain the integrity of the procurement program.

The distinction between these two types of receipt — receipt by the freight forwarder and receipt by the recipient — is clouded by the fact that many shipments are "drop shipped," i.e., they go directly from the manufacturer to the recipient with the freight forwarder receiving the paperwork. NEWVERN makes no distinction between the two definitions of "received" commodities. According to JSI, notification from Matrix that a shipment has been received is sufficient proof of receipt. In fact, Matrix is informing JSI/A.I.D. that the manufacturer and/or Matrix has shipped the commodity, *not* that the recipient has received it.

Recommendations

15. The acknowledgment of receipt of shipments by recipients and the follow-up process should be strengthened. A formalized system should be put in place to (1) ensure that appropriate personnel are

charged with responsibility for monitoring the actual receipt, (2) provide CPSD with sufficient information to follow up on shortages or incorrect commodity shipments with manufacturers and shippers, and (3) initiate corrective action when required.

16. NEWVERN should allow for the tracking of two different types of receipt of commodities: (1) receipt by the freight forwarder and (2) receipt by the in-country recipient.

3.3 Training

3.3.1 Training of JSI and CPSD Staff

The JSI staff assigned to work with NEWVERN is small and collegial. One new employee was hired as a programmer during this evaluation. He received in-depth orientation from each staff person, who described his or her job function in detail. Additionally, the new employee was sent to PROGRESS Corporation for one week of PROGRESS training.

Each JSI person has trained one other person how to do his or her job to reduce reliance on one person for a job function. Job assignments are along functional lines; one person works with orders, one with CPTs, one with production memoranda, etc. The learning curve for JSI data entry staff is long, in part, due to the complexity of operating the NEWVERN software, as well as the inherent complexity of the procurement system. One JSI staff member reported that it took nearly six months to learn everything necessary about entering and managing data in NEWVERN. Improved user-friendliness of NEWVERN could shorten this learning curve for JSI operators as well as CPSD users.

CPSD staff received initial training on NEWVERN when it was installed, and they state that they do not need additional training. JSI staff state they are willing to provide CPSD staff with additional training to help them take fuller advantage of data available in NEWVERN.

CPSD staff rely heavily upon JSI staff to provide answers to queries. CPSD staff call JSI staff routinely with questions rather than attempt to find the information themselves with NEWVERN. Both CPSD and JSI share responsibility for this over-reliance on JSI. When CPSD staff call JSI staff with questions, the JSI person does not ordinarily talk the CPSD person through the NEWVERN screens so that learning will occur. At the same time, CPSD staff have not often availed themselves of information available within NEWVERN.

Recommendations

17. An on-line, self-instructional training approach should be implemented by making NEWVERN more user-friendly and should include on-line documentation.
18. CPSD staff should make an effort to learn what information is available in NEWVERN and how to access it. JSI staff should use CPSD telephone inquiries as training opportunities.

3.3.2 Training of Others

Training for mission and CA staffs has been limited since only a few have the capability to log into NEWVERN. Only a few CAs (e.g., The Futures Group for the SOMARC project) have access to NEWVERN. CDC and Matrix have each received training and have the capability to log into NEWVERN. What is lacking is a clear understanding of what data are available, whether users can expect to receive reports on a regular basis, and the schedules for receipt of reports.

4. Software Development and Maintenance of NEWVERN

4. Software Development and Maintenance of NEWVERN

4.1 Software Design Issues

4.1.1 Software Functions

4.1.1.1 Functional Document

A functional document describes the procedures, i.e., *functions*, that the software must automate. A functional document is generally designed by program experts rather than computer software experts. When JSI was asked by A.I.D. to provide support for the central commodities management function, JSI developed a thick document that attempted to describe A.I.D. functions. This document, developed in 1986 and 1987, was the original blueprint for NEWVERN development. Additional functional documents have not been developed. A detailed listing of the available functions in NEWVERN would provide a useful overview of what is currently automated.

Recommendation

19. A detailed list of automated functions handled by NEWVERN should be developed. Such a listing should be developed in conjunction with a review of the NEWVERN menu system (see Section 4.1.3.6 for a discussion and recommendation concerning improvement of the menu system). In addition, the list of functions in the current system should be developed to a more detailed level.

4.1.1.2 Future Development Needs

Since a large proportion of the data required for financial management already resides within NEWVERN, the development of a reliable system lies primarily in the accurate reporting of necessary pieces of raw data and totals in a useful format. As with other functions that have already been fully automated, however, the design of such a system should also provide an opportunity for improving upon existing A.I.D. accounting procedures and financial reporting. This would require that careful analysis, design, and design review meetings occur prior to programming.

Many other enhancements to NEWVERN would benefit a wider group of users and would also improve work efficiency for current operators. Ongoing systems analysis could identify areas for programming interfaces with other databases to achieve electronic data transfers. For example, demographic information is currently entered into NEWVERN by keyboard entry. Existing demographic databases could be obtained and conversion programs could enter these data electronically. Other interfaces could be developed with Office of Financial Management databases. Systems analysis could also identify other areas of data entry which could be more fully automated by NEWVERN.

Recommendation

20. A separate list of functions yet to be automated should be developed to serve as a long-range planning guide for future NEWVERN

enhancements. High priorities should include a financial tracking system that can be reliably used by the Office of Financial Management and CPSD. Also, more on-line reporting capabilities should be provided in order for CPSD to take advantage of the data already stored in NEWVERN, and to automate the CPSD review and approval processes (see Section 2.1).

4.1.2 Design Review Process

4.1.2.1 Input Procedures

According to the FPLM II contract,

The contractor will provide S&T/POP with a description and justification of any proposed changes to NEWVERN, plus an estimate of the length of time required to make the changes and the estimated cost. . . . Any change made to NEWVERN must be fully documented and provided to A.I.D. within three months of completion.

This contractual requirement for time and cost estimates and documentation is poorly implemented. Time estimates are imprecise, no cost estimates are made, and little or no follow-up documentation is delivered by JSI to A.I.D.

JSI meets annually with A.I.D. to develop a list of enhancements to NEWVERN. The latest list contains 18 enhancement requests, but the descriptions of the enhancements are brief and general. A more thorough design review process would reduce development time in the long run by reducing the possibility of the contractor programming an enhancement only to have the user say, upon completion, "Oh, that's not exactly what I had in mind."

No formal procedures for reporting problems or making requests for enhancements exist; thus, users communicate their needs only occasionally verbally, and rarely in writing. Users have no clear perception of how to communicate their needs regarding NEWVERN, nor with whom to communicate. Both A.I.D. and JSI have, in the past, sent out questionnaires soliciting requests for enhancements from users. These requests have received very little response. Users are too busy to respond or do not know enough about NEWVERN and its potential capabilities to offer suggestions or make requests.

Interviews revealed that JSI and A.I.D. have differing views of the NEWVERN software. JSI's perception is that NEWVERN contains all the data that A.I.D. might want to analyze. It is also JSI's perception that there are no outstanding requests from A.I.D. to program additional reporting capabilities. JSI is waiting for directions or requests from A.I.D. JSI has sufficient reporting capabilities to conduct its daily internal CCM operations.

It is A.I.D.'s perception that greater reporting capabilities can be provided by NEWVERN. A.I.D. staff, however, do not have technical backgrounds in software design and development. They are unable to identify or interpret the data currently available within NEWVERN, and therefore, they are unable to formulate requests properly to JSI to program additional reporting and processing capabilities. For example, one task on the current list of enhancements is to develop a Summary CPT

with "exact format and content to be determined by FPLM, CPSD, CDC, FPSD, and other interested parties." JSI is awaiting direction from CPSD on this issue.

Recommendations

21. More staff resources should be devoted to analysis and design issues and design review meetings should be held monthly or quarterly to clarify and prioritize design requests. The meetings should be attended by both software experts and A.I.D. program experts.
22. A.I.D. should determine and recommend changes to NEWVERN and not rely solely upon the contractor to determine what software modifications are required or desired. A.I.D. should advocate its own needs, provide more direction to JSI, and exercise more contract oversight.

4.1.2.2 Software Trouble Reports and Engineering Change Proposals

In order to manage software maintenance and new development efficiently, it is essential that all requests be committed to writing in a standard format. Requests should be divided into two general categories: engineering change proposals (ECP) and software trouble reports (STR). The ECP is a request for software to be enhanced so that it will do something new or different. It is an addition of a new feature or a change in an existing feature. The STR is a report of a problem in the way the software works or an error in the data.

STRs can be divided into three types: (1) a problem which is interfering with successful operation, (2) incorrect or inadequate processing often resulting in erroneous data, or (3) non-essential issues related to user-friendliness of the software. Typically, when a user reports a problem, it is stated something like this: "The F4 key doesn't work," or "I changed the date in the order, but when I went back to look at it, the date change wasn't there. I *know* I changed it." The user's description of a software problem is rarely sufficient for a programmer to know what to fix.

No list of software problems exists at either A.I.D. or JSI. Sample testing of the software conducted as part of this evaluation identified 21 STRs and ECPs (see Appendix B). Based on this sample testing, it is projected that a thorough testing of NEWVERN would result in 100 or more STRs being developed. Since A.I.D. is not the primary user of NEWVERN, A.I.D. staff are not in a position to identify and report software problems. Currently, when a JSI operator encounters a problem with NEWVERN, he or she either ignores it and works around it or, if that is not possible, reports it to one of the two JSI programmers. Generally, the problem is corrected immediately in the development database and the modified program is then moved into the operational database. No report of these changes is made to A.I.D.

A critical step in the STR process is that of clarification. Someone on the development staff must talk to the user to identify more precisely the location and nature of the problem. The problem must be documented in specific detail before it can be prioritized, evaluated as to how long it will take to correct, and scheduled for correction. Appendix B provides examples of the detail in which ECPs and STRs should be described.

Recommendation

23. A formal procedure (including standard forms for STRs and ECPs) should be developed for users at JSI, CPSD, the Office of Financial Management, missions, and CAs to report software problems and make requests for software enhancements or changes. Each enhancement request should be more fully developed and documented than is currently being done.

4.1.2.3 Prioritization and Scheduling

JSI has developed a two-page annual workplan for NEWVERN for 1992. A lack of detail in the workplan, however, makes it difficult for A.I.D. to determine when and whether JSI has fulfilled each task. The schedule for each task is listed as "ongoing." Therefore, no contractual document exists between JSI and A.I.D. against which A.I.D. can measure task completion. Task number 5, for example, states: "Special reports provided in a timely fashion." In summary, the JSI workplan is a list of responsibilities under the FPLM contract, rather than a list of specific tasks with specific deliverables and specific deadlines.

Currently, when A.I.D. makes a request to JSI regarding NEWVERN, JSI attempts to respond *immediately*, thus delaying work on other tasks that may have been scheduled. JSI's extreme willingness to be responsive means that work assignments are more reactive than planned. Thus, today's request takes precedence over previously prioritized and planned tasks.

Recommendation

24. STRs and ECPs should be prioritized and scheduled in a written document agreed to by both JSI and A.I.D., and A.I.D. should monitor the timely completion of each task. Specific tasks should be documented in detail, analyzed by JSI to determine the necessary level of effort in work days per task, and scheduled with target completion dates. Long-range planning, prioritization, and scheduling of tasks should be adhered to by both A.I.D. and JSI, and new requests should be handled routinely through design review meetings, rather than as emergencies. When A.I.D. makes new requests to JSI, JSI should make A.I.D. aware of how the NEWVERN design and programming schedule will be affected.

4.1.3 Functional Design Features for Users

4.1.3.1 Screen Design

NEWVERN displays information on the screen adequately for a software package that is not intended to be marketed or to be used extensively outside the developer's office. NEWVERN uses screen display methods that are inherent in the PROGRESS language. In other words, NEWVERN frequently uses PROGRESS's default method of displaying data, which reduces time spent programming the display. Thus, NEWVERN's prompts to the user for selecting certain records usually appear in the top left-hand corner of the screen without a title and with little or no explanation.

A programmer, by writing additional code, can improve upon the default methods of displaying data. For example, a programmer can specify exactly where on the screen to display a data entry box (window): centered, row and/or column, title, labels, etc. On-line documentation can also be displayed on the screen. To improve the design of how data are displayed on the screen would approximately double the length of programming time required. JSI has made the decision to devote programming time to increasing the overall functionality of NEWVERN rather than to improving the look of each screen design. This is a standard approach to software development in which the goal of early versions of software is simply to make the software work "adequately" rather than "elegantly." Later versions focus on improving the look and feel of the software.

Two features of PROGRESS utilized by NEWVERN are the ability to scroll and the use of message lines. The scrolling feature is used to make menu selections and also to scroll through records with the highlight bar and then select a particular record by pressing F1. This feature of scrolling and selecting is nicely implemented in NEWVERN. Additional use of this feature would further enhance NEWVERN. Most members of the CPSD staff expressed the desire to be able to scroll backwards, as well as forwards, through records. The enhancement of backwards scrolling, however, would require considerable programming effort.

Recommendation

25. Now that NEWVERN is a more mature software system, the readability of data input screens and reports displayed on the screen should be given a higher priority.

4.1.3.2 Help Messages

PROGRESS reserves the bottom two lines of the screen for help messages. Help messages provide directions to the user for entering data. They can be programmed in one of two ways:

(1) A help message can be entered into the PROGRESS data dictionary for each data field (element). This help message will then appear on the bottom of the screen each time the cursor is in the field on a data entry screen. For example, if the user moves the cursor to a field to enter the "Quantity" in the inventory record, the help message reads, "Enter the amount of product entered into the warehouse." The advantage to defining the help message in the PROGRESS data dictionary is that it need only be entered in this one place. Whenever the user is prompted to enter data into this field, anywhere in the software, the same help message is displayed. This reduces programming effort and future maintenance effort. If the user wants the help message to be modified, the change is made in only one place: the data dictionary. The drawback is that help messages that are defined in the PROGRESS data dictionary are limited to one line. The existing help messages in NEWVERN (which have been defined in the data dictionary) are often short and sometimes lack enough information.

(2) Longer help messages can be included in the actual PROGRESS program. These help messages can be as many lines as desired, with two lines at a time being displayed on the bottom of the screen or multiple lines being displayed in a separate box or window. These help messages can be more specific, providing clearer direction to the user when doing data entry, thus reducing the need for training and assistance. For example, when the user enters a field labeled "Country Code," the help message on the bottom of the screen reads, "Enter a country code." If the user does not know how a country code is designed, or does not know existing country codes, this help message is

inadequate. When more help is needed, the user can press F2 (help) and a help window with longer text will be displayed. The F2 help feature is not yet fully implemented in NEWVERN. Many fields have no help (F2 key) associated with them beyond the one-line message on the bottom of the screen.

Most help messages in NEWVERN *are* more specific, however. For example, when the user enters a field labeled "Rec. Date," the help message on the bottom of the screen reads, "Enter the date the product arrived at the warehouse."

Recommendation

26. Additional help messages should be added to NEWVERN and existing help messages should be improved to provide more specific direction for data entry.

4.1.3.3 Error Messages

Error messages are similar to help messages. They are also displayed on the bottom two lines of the screen, and they can be pre-defined in the data dictionary or included in the PROGRESS programs. Hundreds of helpful error messages are already in the NEWVERN data dictionary. An error message gives feedback to the user when he or she enters unacceptable data. For example, when the user enters a date in a field labeled "Mfr. Date," an incorrect entry results in the following error message being displayed, "The manufacture date cannot be in the future."

It is possible to make some of the NEWVERN error messages more specific, thus providing more help to the user in understanding his or her data entry error. For example, when the user enters an incorrect product code in a field labeled "Product Code," the following error message is displayed, "Invalid product entered." The product code that was entered may actually exist in NEWVERN, but it may not be valid under certain conditions. The general error message "Invalid product entered" does not provide enough feedback to the user to understand why the product code is invalid. In this particular case, the system checks to see whether the product is supplied by A.I.D.; if not, a more precise error message would be, "This product is not supplied by A.I.D." Another example is the error message that appears when the user enters an incorrect year in the field labeled "Fiscal Year." The error message is "Invalid fiscal year." A more precise error message would be "Fiscal year must be between 81 and 99." Often, simply telling the user that "invalid" data have been entered does not provide sufficient feedback for the user to enter data correctly.

Of greater concern is the lack of error messages where they might be appropriate. Sometimes a user can enter data without adequate edit checks being done by the computer on the correctness of the data. For example, when a user selects "Main Menu," then "Maintenance," then "Change Shipment Status," the user is prompted to select an order, then a shipment of that order. Finally, the user is prompted to change the "Status" of the shipment. The status field is one character in length. If a status code is entered that is not stored in NEWVERN, such as "Z," an error message is displayed, "Invalid status entered." If the user presses F2 (help), a message is displayed, "No help is available for this field. Sorry." There is no help to describe available status codes, their meaning, or their correct use. Yet, a user can change the status code without feedback and regardless of whether the status selected is logically correct. No edit check based on the logic of the selection occurs, and, therefore, no error message occurs. The lack of an error message, however, does not mean that the user is prevented from entering erroneous data (see Sections 4.1.4.2 and 4.1.4.3 on validation of data).

Recommendation

27. Additional error messages should be added to NEWVERN and existing error messages should be improved to provide more specific direction for data entry.

4.1.3.4 On-Line Documentation

The PROGRESS language has several excellent features for providing on-line documentation. The F2 key is used for accessing "help files" and displaying them in a "pop-up window" which overlays other windows on the screen. The help file is text defined by the programmer. It can say anything. This help feature allows more lengthy explanations to be displayed than can be defined in the data dictionary and displayed on the bottom two lines of the screen. The F2 help feature can be implemented at the menu selection level or at the field level. The help file can be as long as necessary. At the menu level, it can be used to describe a procedure or a report. At the field level, it can be used to describe how a field is composed, such as a contract number; it can describe rules and conditions, such as when to use certain dates or codes; it can list existing records, such as all the existing country codes. When used in combination with the help and error messages displayed at the bottom of the screen, the F2 key provides a powerful design feature for making users independent, thus reducing training time and user support.

When a user reads the error message "Invalid <field> entered," he or she can press F2 and get a full description of valid field entries and conditions when each can be used. This feature is implemented in some, *but not most* places in NEWVERN. A major enhancement to NEWVERN would be to implement fully the F2 help feature at both the field level and menu level.

In some places where the F2 help is implemented, a pop-up window appears with text directing the user to press the PAGE-UP and PAGE-DOWN keys to scan through existing records, such as order numbers. In some instances, the PAGE-UP and PAGE-DOWN feature is not yet implemented for scanning through records, even though the help screen tells the user to use those keys. Thorough testing of NEWVERN should identify these occurrences.

Another form of on-line documentation that is not implemented in NEWVERN is descriptions of reports and procedures. Documentation that is written for user's manuals can also be displayed on the screen. Any text file used in printed documentation can be displayed on the screen by using the PROGRESS command "quoter." In this way, only one version of the documentation need exist. By displaying the same text on the screen as is written in the user's manual, the maintenance effort in updating documentation is greatly reduced. Only one version of documentation need exist and that same version is both printed and displayed on the screen. The development of this on-line documentation requires careful design before programming. The development is time-consuming, but will result in reduced training and user support. It will help to institutionalize the software, thus guarding against problems resulting from employee turnover at both JSI and A.I.D. On-line documentation should be considered as one of the final development projects to make NEWVERN a finished product which can be effectively used outside JSI.

It is especially important to describe on the screen procedures which the user selects from a menu, but which are carried out by the computer. For example, when the user selects "Main Menu," then "Maintenance," then "Set Back Production Memos," a screen displays the following text:

**This procedure will set back the 'current' month for production memos and/or the current amendment number.
IF YOU ARE NOT SURE YOU WANT TO DO THIS, ANSWER NO!!
Continue? no**

On-line documentation of procedures such as the above example should explain more fully to the user what processing will occur if the procedure is run and what the consequences of the processing will be. A user should be fully informed as to what processes occur even if they are automated by the computer.

On-line documentation of reports should describe the report contents and use before the user selects it to be printed. This is especially important because many of the reports cannot currently be viewed on the screen; they can only be printed. Infrequent users of a report often cannot remember the name of the report. Without on-line documentation, it is difficult for such a user to identify the appropriate report simply by reading a short menu selection.

Recommendation

28. On-line documentation in the form of pop-up windows, descriptions of procedures and reports, and specific directions for data entry should be added to NEWVERN to reduce training and support requirements and to increase usability.

4.1.3.5 Cursor Movement

Cursor movement is satisfactory throughout NEWVERN. In some instances, however, the F4 (end or exit) key exits the user to an inappropriate or unexpected screen. Sometimes the F4 key undoes changes made to a record without informing the user that his or her changes were not saved. This problem is not so much one of cursor movement, but has to do with what is referred to in PROGRESS as "transaction scoping." Scoping a transaction has to do with deciding and appropriately designing what processing should occur and where the cursor should return to when the user presses the F4 (exit) key. Thorough testing of NEWVERN can identify improper or problematic transaction scoping. It is not always, or even usually, immediately apparent to a user.

4.1.3.6 Menu Design

There are three types of selections in any computer system. A user can select (1) a procedure to run (either data entry by the user and/or automated processing by the computer); (2) a report to view or print; or (3) a submenu with additional selections. Careful naming of each menu selection can indicate to a user which of these three types of actions will occur. This process is not always clear in the NEWVERN menu system. A.I.D. users reported confusion in using the NEWVERN menu system to find what they wanted.

By adding the word "Menu" to the end of menu selections, the user knows that he or she will see a submenu of additional selections. For example, "System Administration" can be changed to "System Administration Menu;" "Attribution Reports" can be renamed "Attribution Reports Menu."

Menu selections that trigger procedures should start with a verb, such as reschedule, transfer, adjust, add/update, delete, view, or load. For the most part, NEWVERN menu selections abide by this rule; e.g., "Add/Update a Commodity Source." The use of verbs is not consistent throughout NEWVERN, however. For example, a NEWVERN menu selection reads "Add/Update Contracts," but the resulting data entry screen reads "Updating Contracts." It is unclear whether the selected process allows the user to add a new contract or only to update one.

Another source of confusion in the naming conventions of the menu selections is that selections listed in a menu sometimes result in the display of a screen with a different title than the one selected. Most of these differences are minor. For example, when "Permission Menu" is selected, the resulting screen is entitled "Permission Maintenance." Other menu selections are slightly more confusing, however. When "Shipment Processing" is selected off the main menu, the resulting screen is entitled "Shipment Updates." When "Contract Data" is selected, the resulting screen is entitled "Contract Administration." Some screens have no titles at all. Three separate menus with different selections are *all* entitled "CPT Menu." When "Modify Other Essential Data" is selected from a menu entitled "CPT Menu," a different menu appears, also entitled "CPT Menu."

The NEWVERN menu system has four hierarchical menu levels, which causes some confusion to A.I.D. users in locating what they want in NEWVERN. This results in A.I.D. users' calling JSI for information rather than using NEWVERN themselves. The information they want is often within NEWVERN, but they cannot locate it quickly enough.

A conceptually logical and consistent naming structure is necessary for any software so that the user can find what he or she wants within the menu hierarchy and can move quickly throughout the menu system. Also of great importance is the use of the menu system to describe the exact location within NEWVERN when a user requires phone assistance or when a problem is reported on a Software Trouble Report.

A consistent naming structure is essential for any software menu system so that each module can be managed. This is referred to as "configuration management" (see Section 4.2). Menu systems are frequently mapped out with a coding or numbering system, such as the numbering system used in this report, so that users and developers can communicate with each other about locations in the software.

Recommendation

29. The NEWVERN menu system should be modified so that selections listed in menus correspond exactly with titles displayed on the selected screens. Modifications to the menu system should improve the conceptual organization and naming of the procedures and reports so that users can locate their choices with greater speed.

4.1.3.7 Reports

Users should be able to view all reports, including listings of records, on the screen. NEWVERN has a module for printing which allows each user to designate a printer and to change the designated printer. The printing module also allows the user to direct a report to the terminal for viewing, rather than to a printer. Many of the NEWVERN reports, however, are not formatted to be displayed on the terminal screen. Thus, the user is often forced to print whole reports in order to

get data, even if just one small piece of data is desired. This also generates paper that would not be necessary if reports could be viewed on the terminal.

Enhancements to NEWVERN could include more listings of all records stored in the database. Two kinds of reports that would be especially helpful are summary listings and detailed listings. A summary listing would list one record per line, thus allowing approximately 15 to 20 records to be viewed at once on the screen and up to 45 records to be printed on one page. Summary listings would print/display only selected fields of information from each record. Detailed listings would print/display all fields of information for one record. By using the PROGRESS scrolling function, a user could scroll through a summary listing of records, then select a detailed listing of a desired record by pressing F1.

Enhancements to NEWVERN could also include more reports for managers to use in analyzing, planning, and financial management. Thorough discussions with users should identify their needs. More reports for operators can provide them with an overview of their work-in-progress.

Another enhancement to the design of reports could be the ability of users to select which records to list in a report. The user should be able to enter the selection criteria for record selection; for example, within a date range, over a certain dollar amount, only for a certain country, records with a certain status, a certain method, and so forth. Basic set theory should be used to enable the user to select records based on up to five or six selection criteria; e.g., "select all orders not yet received of condoms for Pakistan," or "select all orders received from all countries for Ovrette in 1992." The same PROGRESS program should be able to produce numerous customized reports that are formatted identically, but which list different records. By using variables whose values are designated by the user, a proliferation of "hard-coded" programs for each customized report can be avoided.

In some cases, when records are listed on the screen, if there are more fields in each record than can be listed across the screen in one row, the data are wrapped around to the next line. The labels or titles for each field are displayed at the top of the screen. Reading the data and matching each data field with the correct label is often difficult. This type of display of records occurs when the program uses the PROGRESS default screen layout. It enables a simple program to be quickly written in order to read the contents of a record. The readability of these reports would be greatly enhanced if additional programming were done to redesign the report layout so that it could be read more easily.

Another enhancement would include on-line documentation of all reports (see Section 4.1.3.4).

Recommendations

30. Reports should be designed so that they can be viewed on the screen as well as printed.
31. More reports should be developed in two areas: (1) listing of all records in master files and (2) analysis of data for financial and operational management. Report design should be improved to increase readability. Users should be able to customize reports through multiple selection criteria.

4.1.3.8 Overall User-Friendliness

When taken individually, most of the problems identified with the software relate to non-critical issues of user-friendliness. When taken collectively, however, there are so many places in NEWVERN in which the user can become "stuck," thus requiring assistance, that the software overall is difficult to use. A.I.D. staff confirm this perception. Although JSI staff maintain that nearly all desired data are already available to A.I.D., A.I.D. staff maintain that they do not know how to access or interpret the data. As stated in Section 3.3.1, the learning curve for JSI data entry staff is long, in part, due to the complexity of operating the software.

Recommendation

32. The multitude of minor problems which frustrate the NEWVERN user should be corrected.

4.1.4 Technical Design Features and Data Integrity

4.1.4.1 Structured Programming

Inherent in the PROGRESS programming language is a structured or modularized approach. JSI has done a good job of using structured programming in NEWVERN and avoiding unnecessary duplication of code. This makes it easier to read and understand small sections of code. In other words, sections of code are self-contained in small blocks. Processes that occur multiple times in different places in the application rely upon the same set of code. Sections of code are not needlessly duplicated. Variables are used effectively in the NEWVERN code. Since variables are required to accomplish this structured programming, however, reading the code is made more difficult. Internal documentation of each block, especially where variables are used, would increase the readability of the code.

Written documentation summarizes each PROGRESS procedure in approximately five lines. These procedures are divided into the following 16 major modules: menu system, printer system, background file maintenance system, contract system, customer and recipient system, funding system, warehouse system, Matrix interface system, order processing system, shipment tracking system, CPT subsystem, generic tools, help system, security system, data integrity system, and miscellaneous procedures.

4.1.4.2 File Relations

The PROGRESS data dictionary currently has the ability to identify file relations. Where field naming conventions do not allow this, however, PROGRESS cannot identify relations between files (see Section 4.1.6.1 for a discussion of the implications of this). Because PROGRESS cannot identify all file relations within NEWVERN, additional written technical documentation is needed before the integrity of the file relations can be completely tested and validated. Additionally, technical documentation is required which describes, *in technical terms*, the conditions under which file relations are required. For example, the "contract" file is related to the "shipment" file. Initial testing of NEWVERN, however, identified hundreds of shipment records that did not have a related contract record. Through discussion with the JSI developer, it was discovered that shipment records require a contract record *only under certain conditions*. Similarly, eight post records are missing the related fund record. Some fund records are missing a related source record. Hundreds of shipment records

are missing the related fund records. Because so many of the file relations are not always mandatory, it is difficult to track the flow of data as they are processed.

Many of the file relations are mandatory only under certain conditions. These relations generally reflect A.I.D. procedures which allow for hundreds of exceptions to the rule; e.g., "all shipments must have contracts *except* in certain cases," "all demand records must have CPTs *except* in certain cases," and "all funds must have sources, *except* in certain cases."

The conditions that make file relations mandatory are not completely documented in one location. Therefore, programs to test for these required relations cannot be developed easily until the documentation is provided. No PROGRESS programs currently exist to test all of the NEWVERN file relations and to find missing required records.

Initial testing of NEWVERN file relations suggests one of two possibilities: either some records are missing within the database, or the manner in which A.I.D./JSI conduct business has so many exceptions to the rule that a straightforward design of required file relations is impossible. If the former is true, the logic of the PROGRESS programs needs to be corrected. If the latter is true, each instance of complexity needs to be documented and a suggestion for streamlining work procedures submitted to A.I.D. Automation — changing procedures from manual paperwork to computerized processing — provides an opportunity for an organization to improve the manner in which it does business, thus improving efficiency. Automation should not simply mirror manual operations; it should improve and simplify operations. Initial evaluation of the NEWVERN file structure suggests that more streamlining of A.I.D. and JSI procedures can occur.

The NEWVERN database is a relational database. The evaluation examined whether the database was "normalized," i.e., whether data were stored only once within the database without data redundancy. For example, the address of a mission should be stored in only one record. Every time a report requires that address the system should "look it up" in the one record where it is stored. NEWVERN observes these general rules of database design.

NEWVERN does, however, store pieces of data that are calculated, such as the total amount on hand of a particular product. At least six files are used to store calculated totals. Since a computer can perform mathematical functions, such as adding up figures, within nanoseconds, totals are generally not stored in databases. Totals are generally calculated each time they are wanted. When the sheer volume of records, however, is so massive (over 10,000 in PROGRESS) as to slow processing down to an unacceptable time, then totals might be stored. By storing totals, a report that lists totals can be instantly displayed on the terminal screen.

The JSI developer of NEWVERN explained that totals are stored within NEWVERN in cases where the processing would take approximately one minute. This was considered an unacceptable time for a user to sit waiting in front of the terminal. Spot testing of these totals, however, found no totals whose calculation took more than five seconds. Most calculations of stored totals took less than one second. For example, it took less than one second to add up all the on-hand inventory amounts (inv.in_amt) into one total. It takes less than one second to calculate the total of all PIO/C amounts (pioc.pi_amt). Further testing and validation of NEWVERN are required before a conclusive recommendation can be made on whether the database should be simplified by eliminating any files which store only totals. (See also Section 4.1.4.3.)

Recommendation

33. All file relations should be more fully documented so that thorough testing and validation of the software can occur. This documentation should include a listing and graphic mapping of all file relations; the fields upon which each relation depends; whether the relation is optional or required; and, if optional, under what conditions.

4.1.4.3 Validation

Validation means checking to make sure data are correct. Validation occurs at various levels. Field-level validation performs "edit checks" of data entered into an individual field. For example, if a field is defined as an integer, entry of a character should be rejected. If acceptable status codes are "O, P, M, S, or R," then entry of "Y" should be rejected. If a field is required, such as a country code, leaving the field blank during data entry should result in an error message and force the user to re-enter the field.

The PROGRESS data dictionary allows the programmer to enter validation criteria for each field. Then, every time that field is entered in NEWVERN, the data are checked against the validation criteria in the data dictionary. The following criteria for each field can be defined in the data dictionary:

- mandatory/optional
- integer/decimal/date/character/logical
- case sensitive
- view only (cannot be changed by the user)

Additionally, acceptable codes can be defined, such as status codes. More complex edit checks can be looked up in another file. For example, the warehouse code entered into an inventory record can be looked up in the master warehouse file and checked. If the warehouse code does not exist in the warehouse file, the data entry is rejected.

A mandatory parent record (file relation) can be defined in the data dictionary when index names match between files. For example, a user is not allowed to enter a fund ID into an attribute unless a fund record with that ID already exists (i.e., do not allow an attribute for a non-existent fund).

It is also possible in the PROGRESS data dictionary to define another program, called an include file, which should be run to validate the data entry. The NEWVERN data dictionary incorporates all of these validation features, thus reducing time spent programming edit checks into each procedure. The edit checks defined in the data dictionary represent the hundreds of rules that establish data integrity. It was not possible for this evaluation to examine each edit check for completeness or for logic. Thorough testing of the software is required to determine whether the NEWVERN edit checks are accurate and complete.

A different type of validation or edit check of data is "conditional." The acceptability of data in one field often depends on the data contained in another field or fields. For example, although the status code of "R" for "received" is a valid status code (listed in the status file as one of the nine acceptable status codes), it is only correct under certain *conditions*. A shipment should not, for example, be given a status code of "R" for "received" if the shipment is missing a shipment date (shipment.s_shp_dt

= ?), indicating it has not yet been shipped. In fact, no such edit check for acceptable conditions occurs when a user enters a shipment status code. Edit checks, also called validation, of all data in NEWVERN should examine the conditions under which data are entered and reject data that do not meet all of the conditions.

Another type of validation occurs when a record is deleted. No record should be deleted if a dependent record still exists for it. For example, a customer should not be deleted if a shipment for that customer is still being processed. In this case, the customer record is a required "parent" record of the dependent "child" record. Until all of the conditional file relations are documented, it is not possible to examine the software to see if proper validation occurs before records are deleted.

On another validation issue, a set of about 10 programs is run each week to check the accuracy of the database. These programs may only be run by the system administrator. The programs recalculate the totals which are stored in certain records. For example, the total of each product available at any time (production less orders) is stored in the on-hand file (on_hand.oh_amt). The total funds used is also calculated according to a formula and stored in the field fund.f_used. When the calculated totals do not equal the amount actually stored in the "total" field, NEWVERN corrects the stored total to reflect the calculated total. If corrections are made, a message is printed to a log file for the system administrator to study. The JSI developer reports that this log file is used to pinpoint errors and correct the data and/or the code. He reports that most of the major problems have been corrected.

The combined log files from database checks dated March 22 and March 29, 1992, when printed, were 19 pages long. The following types of errors and messages to the system administrator were listed:

- orders with incorrect amounts (order.o_amt); amounts were corrected
- 15 freight records had costs which exceed funds available
- over 100 PIO/Cs with funds exceeded — unfunded PIO/C
- dozens of fund records: BATs without Docs or Secondary funds
- funds with incorrect "used amount" (fund.f_used); amounts were corrected
- no-link, deleting 641-CSM VFTS 1994 -1,392,000
- demand based on shipments only incorrect
- Qty controlling amt adjusted
- eight customers where funds used > total
- incorrect demand records; amounts were corrected
- vouchers with write-offs
- funded PIO/Cs without attributes
- shipment freight cost flag changed
- freight records in which costs exceed funds available
- for 13 demand records: product not supplied by A.I.D.
- 52 post records with the message: Fund reset
- For customer 277-A.I.D.: \$90,000.000 A.I.D. funds over or under used
- fund type mismatch (when checking PIO/C records)
- negative on_hand OVRP 09/30/92 -220800
- resetting attribs for Condom

The log file raises questions about the meaning of the error messages. The JSI developer stated that the only fields in which amounts were changed were those holding calculated amounts; raw data were

not changed. Certain questions must be asked: How did these amounts get to be incorrect? How did a flag get set incorrectly? How did a link between records get broken? How did a negative inventory amount occur? How did an order get processed for a product not supplied by A.I.D.? Not only should the data be corrected, but it is essential that the procedure or computer program which allowed the error to occur be corrected so that similar errors do not continue. There are limited ways in which errors can be introduced into the database. These are

- (1) the user is permitted to enter erroneous data, often overriding a rule or entering data that should be set by the computer; this includes entering an amount in a "total" field or a status in a "status" field;
- (2) the user or the system is permitted to delete a required record, thus throwing off totals or destroying required record relations;
- (3) the logic of the NEWVERN code calculated and automatically entered erroneous data; or
- (4) the NEWVERN database had erroneous data loaded either through historical baseline data or electronic data transfers.

Recommendations

34. Software validation testing of NEWVERN should examine the accuracy and completeness of all edit checks (validation) within NEWVERN. These edit checks should reflect A.I.D.'s rules of doing business.
35. The contractor should develop additional programs to test for file relations and data integrity.
36. The contractor should identify data discrepancies in the database and every effort should be made to eliminate this situation. If A.I.D. is conducting business in such a manner as to cause discrepancies in the database, then recommendations for change should be made, in writing to A.I.D., by JSI. If old baseline data are causing these problems, then every effort should be made to handle the issues surrounding these old data and "clean" the database. If NEWVERN permits a total to somehow become incorrect, then the logic of the PROGRESS code should be corrected.
37. If accounting information is contained in the weekly log file created by the database check, then the procedures which create the accounting messages should be placed within the NEWVERN menu system. A.I.D. staff should routinely monitor these accounting messages and exercise oversight.

4.1.4.4 Processing Speed and Indexing

Indexes are used in programming to pre-sort records in a certain order and, thus, speed up processing. The use of an index is especially obvious when a report is being prepared. Use of an index in PROGRESS can speed the display or printing of a report from 1 hour to 5 minutes, or from 5 minutes to 10 seconds. NEWVERN has hundreds of indexes defined in the data dictionary. This

evaluation did not examine whether these indexes were all used or were well designed for maximum processing speed. Neither did the evaluation examine each PROGRESS program to see if indexes were effectively used.

Recommendation

38. Software validation testing of NEWVERN should examine the use of indexes to identify which ones, if any, are not used and can be eliminated and which new indexes can be created to speed processing. This should be a low priority after other testing is completed.

4.1.5 Security

4.1.5.1 Login and Passwords

The UNIX operating system, on which NEWVERN runs, provides the ability to assign a "login" name to each user. Each user then protects his or her own login name with a password known only to the user. UNIX encrypts the password and stores it in a file called "/etc/passwd." Users may only change their own passwords. A user with "super user" permission may neither read nor change anyone else's password, but he or she may delete passwords. A login name without a password can be used by anyone, thus leaving a system wide open to unauthorized use.

Examination on April 1, 1992, of the password file on the central processing unit (CPU) on which NEWVERN resides revealed 65 login names without passwords. A brief test of some of these login names showed that a user could log onto the JSI menu system, get to the operating system prompt, and access nearly all files on the CPU. Although not all of these login names worked successfully (for other reasons in the UNIX system design), enough of them did work. Some of these unprotected login names have not been used for 10 months or more. It takes only one login name without a password to make a system vulnerable to unauthorized use, especially by a disgruntled former employee. In one hour of testing, the evaluator was unable to get permission to be a super user. A persistent "hacker," however, would likely be able to become a super user.

Recommendation

39. All login names (whether system names or user names) should be password protected and the responsibility for enforcing this should be given to a system administrator for the CPU (not just NEWVERN). To do this, the system administrator should monitor the /etc/passwd file. Inactive login names should be deleted or disabled, and users who leave their login unprotected should be locked out of the system and forced to see the system administrator (or manager) to regain access.

4.1.5.2 Network and Phone Connections

Remote access to NEWVERN is allowed via modem connection. For example, A.I.D. managers access NEWVERN from their own offices. By putting a system on-line via modem to outside users, the possibility for unauthorized use exists. This is a necessary trade-off for easy and timely access to information. Only the most sensitive data would dictate prohibiting access to a system via modem

or network connection. In actuality, even the most sensitive data in the country, such as that in the Central Intelligence Agency and military databases, can be accessed remotely.

Although the issue of computer security is complex⁵ and was beyond the scope of this evaluation, it is important to note that the JSI NEWVERN developer/system administrator is aware of the myriad security issues related to protecting a system from viruses, piracy, and unauthorized use.

4.1.5.3 UNIX File Permissions

The UNIX operating system is designed to give or deny permission to access a file to three categories of users: (1) the person who wrote or "owns" the file or program, (2) anyone assigned to a particular group, such as the "fplm" group, and (3) anyone else, not included in 1 or 2. Within each of these three categories, a file can have *read*, *write*, and/or *execute* permission. (In UNIX, the term "file" refers to both data files and computer programs.) To protect a file from unauthorized or accidental modification, it is generally assigned read permission, but not write permission. A user with super user (root) permission, can read, write, and execute any file on the CPU.

The primary use of a security system is to protect against unintentional mistakes, such as deleting or modifying a file, by internal users. Examination of the file permissions show that the active (operational) NEWVERN database files have read-only permission, thus protecting them from either intentional or accidental modifications. All modifications to the NEWVERN software are made to a copy of the database that is used for development and testing. When the changes to files are finalized, the changed files are moved into the operational database with read-only permission.

4.1.5.4 NEWVERN Permission System

NEWVERN has a security system which was designed into it. Based on a user's login name, he or she is given permission to do different functions within NEWVERN. This system provides the ability to give different groups of users different permission to do certain activities. For example, permission may be restricted to updating data in a field, deleting a record, or accessing the administration menu. Implementation of a security system is limited, but the design already exists to restrict permission to additional activities should it be desired.

As discussed in Section 2.1, although A.I.D. staff retain decision-making authority on program matters, JSI staff are charged with responsibility for daily operations. Currently, A.I.D. personnel are prohibited from entering the system administration menu and the maintenance menu. Consequently, A.I.D. staff are prevented from performing data entry and from reading certain reports, especially the log file which contains error messages.

On the issue of audit trails within NEWVERN, the design of the NEWVERN data dictionary provides for each record to be tagged with the date and login name whenever the record is changed. This feature is inconsistently implemented within NEWVERN. Another file within NEWVERN is called "post," for posting transactions. Time did not permit the issue of an audit trail to be studied in-depth. Further analysis of A.I.D. requirements should recommend a design for providing an

⁵One of the most revealing books on the subject (as it relates to UNIX systems) is *The Cuckoo's Egg* by Clifford Stoll (Doubleday, 1989).

acceptable audit trail. The final recommendation should be reviewed and approved by a controller and appropriate financial managers within A.I.D. before NEWVERN implementation.

Recommendations

40. A.I.D. managers should be given permission to read data in NEWVERN's system administration module, which provides error messages and exception reports.
41. NEWVERN should be analyzed to determine if an adequate audit trail exists for financial accounting.

4.1.6 Programming Standards

4.1.6.1 Naming Conventions for Fields, Variables, Files, and Procedures

In order for PROGRESS to identify relations between files, key fields which relate one file to another, such as a shipment of an order, must be given the identical name. A key field or group of fields is what identifies a record as being unique. In the order file this field is the "Order Number." Within the PROGRESS data dictionary the Order Number is named "o_num." To be able to find all shipments of an order, each shipment must also carry an "Order Number." The field in the shipment record should also be named "o_num" in order to match it to the correct order. PROGRESS looks at the "o_num" field in an order and at the "o_num" field in each shipment, and where the numbers in that field match, PROGRESS knows that the shipment belongs to that particular order.

The PROGRESS code for finding file relations is very simple when the naming convention for fields is adhered to. In the above example of finding shipments of each order, the code would look like this:

```
for each order:
    for each shipment of order:
        <whatever processing is desired goes here>
    end.
end.
```

When key fields of related files are given different names, the PROGRESS programming effort becomes more difficult, because PROGRESS cannot automatically find related records. For example, PROGRESS cannot automatically find customers of a country because in the customer file, the country number that identifies which country that customer belongs to is embedded in the customer code.

The customer code in the customer file is named "cu_code." It is eight characters in length. The first three positions contain the country number, such as 000; the fourth position is used for a hyphen; the fifth through eighth positions are used for the customer abbreviation. For example, in the customer code (cu_code) 000-WHRI, 000 is the country number assigned by A.I.D. for the United States and WHRI is the code assigned to IPPF/Western Hemisphere.

The country number in the country file is stored in a field named "cy_num." For the United States, the country number is 000. Because the names "cy_num" and "cu_code" are different, PROGRESS cannot automatically identify the relationship between the customer file and the country file; that is, PROGRESS cannot find customers for each country. In order to do this, additional programming is required. It would look like the following:

```
for each country:
    for each customer where
        integer(substring(customer.cu_code,1,3)) = country.cy_num:
            <whatever processing is desired goes here>
        end.
    end.
```

In most instances, NEWVERN field names can be used to find file relations. In some important cases, however, the file relations cannot be established based on field names, because fields which contain the same data are given different names in different files. This *can* be managed; however, it increases the programming time for the contractor to do maintenance and enhancements. It makes it infeasible for users to query the NEWVERN database with simple PROGRESS code as in the first example (shipments of orders).

In instances in which files are related, but the fields which establish the relationship are given different names, the relationship is not obvious to either PROGRESS or to the programmer. These relationships are not documented. A programmer would have to study the source code to identify the relationships. In an active database which already holds many records, a programmer could study the contents of fields to identify fields in different records which contain the same data. In this way, relationships could also be identified.

On another issue, when writing PROGRESS code, it is not necessary to specify the file name every time a field name is referenced unless two different files are being examined (opened) simultaneously, which both have a field with the same field name. For example, in the NEWVERN database, both the "order" file and the "shipment" file have a field named "o_num." If PROGRESS code refers to "o_num" when both an order record and a shipment record are being examined, a PROGRESS error message will indicate that the use of the field name "o_num" is ambiguous. In order to eliminate ambiguity from the code, it is necessary to specify which file is being referred to — the order file or the shipment file. To do this in the code, the file name followed by a period precedes the field name (filename.fieldname). For example, "order.o_num" refers to the o_num field in the order file. The file name is *only* required when ambiguity would result; otherwise, it is sufficient to refer to a field with the field name alone. In most instances, the NEWVERN code refers to fields with the field name alone, without referencing the file name. There is no problem with ambiguity in naming fields within the NEWVERN code since any ambiguity would prevent the program from running. The practice of not explicitly naming the file, however, reduces the readability of the code and increases maintenance efforts.

Naming conventions for file names and PROGRESS procedures (programs) is adequate, easily understood, and documented in the technical manual, dated March 4, 1992. The names of procedures which do edit checks (validation) end with a ".v." These procedures, called "include files," are not documented in the technical manual, but do reside in one directory on the computer for easy reference by a programmer.

Recommendations

42. In order to increase readability and decrease maintenance efforts, standards should be developed for naming fields in NEWVERN. These standards should be consistent with PROGRESS requirements for finding file relations.
43. The PROGRESS convention of referring to fields within the code with their file name (filename.fieldname) should be adopted for use throughout the NEWVERN code to increase the readability of the code and reduce maintenance efforts. Standards for naming buffers, workfiles, and variables would also increase the readability of the NEWVERN code.

4.1.6.2 Block Headers and End Statements

PROGRESS code is written in logical building blocks called transactions. A transaction begins with a block header statement that ends with a colon; e.g., "For each order:". It ends with the word "end." Numerous transactions can be embedded within other transactions, making it more time-consuming to know which "end" statement corresponds with which block header. Simple documentation of "end" statements would make it easier to read the code and to follow the processing logic. For example:

```
for each order:
    for each shipment of order:
        <whatever processing is desired goes here>
    en... /* for each shipment */
end. /* for each order */
```

A block header can also be given an explicit name to improve the readability of the code. Capitalizing the block header name makes it easier to locate when reading code. For example:

```
CHECKAMT:
for each shipment:
    <whatever processing is desired goes here>
end. /* CHECKAMT */
```

Since the NEWVERN code is already written, going back to it now to document the block header statements and the "end" statements would be time-consuming and offer no immediate benefit. It would, however, improve readability for new programmers who might be assigned to maintain and enhance the code.

Recommendation

44. A standard of giving names to long blocks of code and documenting the corresponding "end" statement with a simple comment string should be adopted.

4.1.6.3 Indentation and New Lines

Certain styles of indentation and beginning new lines are used to increase the readability of code. Style has no effect on whether the code will run properly. Excellent use of indentation and new lines has been used in NEWVERN, greatly increasing its readability.

4.1.6.4 Capitalization

Although capitalization is not used in NEWVERN and PROGRESS does not require it for the code to run properly, certain uses of capitalization can increase the readability of the code. The PROGRESS manuals suggest a standard of capitalizing all PROGRESS key words, but this standard is cumbersome to use and annoying to read. JSI developers, however, might consider using capitalization for block headers and end statements to make them stand out. Capitalization might also be used for variables, buffers, and workfiles to distinguish them from files and fields.

Recommendation

45. Capitalization should be considered when developing standards as one way of enhancing readability of the code.

4.1.6.5 Audit Trail

Within the NEWVERN data dictionary, every file has two fields which are used to make an audit trail of every time a record is changed. One field stores the current date; the other field stores the login name of the user who changed the record. If a record is changed by the system, "newvern" is listed as the user making the change. It may be useful when analyzing data to know whether a record was changed by an operator or by the system. This feature is inconsistently implemented in NEWVERN. In some places, the login name and date are posted to a record when it is changed; in other places they are not posted. Further analysis is required before a recommendation can be made either to implement this feature fully, or to eliminate it altogether in many files.

4.1.6.6 Internal Documentation

Most NEWVERN PROGRESS procedures include documentation at the beginning of the procedure. This documentation is brief and general. There is little documentation throughout the body of each procedure.

Recommendation

46. A standard header for each PROGRESS procedure should be developed. Minimally, the header should include the name of the procedure, summary of the procedure, each modification date, specific nature of the modification, and full name of each person who wrote the procedure or made a modification. Additionally, the header might include called programs, programs which call the procedure, and files opened. More internal documentation with block headers would improve the readability of the NEWVERN code, thus reducing maintenance efforts.

4.2 Configuration Management

4.2.1 Hardware Environment

The FPLM II contract requires that R&D/POP, CDC, and Matrix staff be permitted access to NEWVERN at all times via modem. Currently, CPSD staff enter NEWVERN through a network system in A.I.D. which then dials NEWVERN. Access time is several minutes and is so slow that CPSD staff do not feel they can rely on NEWVERN to look up answers to questions quickly, particularly when handling an overseas telephone inquiry. Modems that would permit direct dial into NEWVERN, thus bypassing the A.I.D. network, would be a solution to this situation.

NEWVERN resides on a computer owned by A.I.D. and operated by JSI, located in Rosslyn, Virginia. The computer is an Altos 486 with 880 megabytes of hard disk storage and 32 megabytes of random access memory (RAM). It runs at a speed of 33 megahertz. In other words, this is an extremely powerful, state-of-the-art microcomputer.

Both the NEWVERN development database and the NEWVERN operational database reside on the same computer. This reduces the time spent when moving changes from the development database to the operational database. Also, since there is only one operational NEWVERN database, management of changes to it is simple. If and when NEWVERN is installed at other sites, the management of multiple NEWVERN databases would create increased demand on JSI staff time. It is not recommended at this time that separate NEWVERN operational databases be considered. The centralized management of NEWVERN operations allows the cost of software support to be held down. Decentralized computing, with multiple databases, escalates support costs. If other users outside JSI want to access NEWVERN, this access would be best done via modem into the JSI CPU.

If A.I.D. decides to conduct periodic independent testing and validation of NEWVERN, such testing could be conducted on a separate computer running UNIX and PROGRESS, located anywhere. Alternatively, it could be conducted on-site or via modem on a copy of the database residing on JSI's Altos computer. Since testing does not involve changing programs, it does not matter whether testing occurs on a different computer. There is no concern for having to manage diverging versions of NEWVERN.

Other JSI programs and data reside on the same computer as NEWVERN. Since the NEWVERN database is only 10 megabytes in size and the Altos computer has 880 megabytes of storage, no additional storage requirements are anticipated. Processing speed is currently adequate for the number of users. Typically, 10 programmers can develop on the same UNIX system with satisfactory processing speed. New technology and increased RAM (such as 32 megabytes) can handle up to 250 users.

Recommendation

47. A.I.D. staff should be provided with faster connection time to NEWVERN, possibly requiring additional high-speed modems.

4.2.2 Software Environment

4.2.2.1 Operating System

NEWVERN runs on the SCO UNIX operating system, which was developed in the 1970s by Bell Laboratories. UNIX is a widely accepted operating system which permits multiple users and multiple processes to run concurrently. Thus, it is more appropriate than MS-DOS, which is a single-user operating system. It is also more cost effective than the VMS operating system, which runs on more costly VAX computers. UNIX is the ideal choice for the operating system.

4.2.2.2 Programming Language

PROGRESS is the language in which the NEWVERN application is programmed (see discussion in Section 2.5). It is possible to port (transfer) an application written in PROGRESS to either the MS-DOS or the VMS operating system. Thus, if future development of NEWVERN required a mainframe computer running the VMS operating system, NEWVERN could be run on it. NEWVERN cannot currently be run on an MS-DOS system because some of its file names are longer than the maximum of eight characters allowed by MS-DOS. If a decentralized version of NEWVERN running on a PC with MS-DOS were ever desired, modification of NEWVERN would be required.

PROGRESS is a high-level, English-like programming language which is relatively easy for users to learn so that they may query their database. This may not be feasible, however, because of the complexity of the NEWVERN data dictionary. Because PROGRESS code follows certain structured standards, it is possible for a PROGRESS programmer to read and understand another programmer's code, even when it is undocumented. NEWVERN has very little internal code documentation, but it is written in a reasonably good style which increases its readability. Although additional analysis time would be required, a PROGRESS programmer outside JSI could take over support of NEWVERN if necessary.

4.2.2.3 Management of Source Code and Object Code

NEWVERN was developed by only one PROGRESS programmer/analyst, who continues to make all changes to the code with the exception of code related to the CPT module. In March 1992, a new employee was hired and sent to a PROGRESS training class. He is to have responsibility for making changes to the NEWVERN code. Since up to this time, only one person has made code changes, there was no need for formal procedures for managing the code.

As soon as more than one person has responsibility for changing software, procedures for "configuration management" must be implemented. One person must be responsible for managing the work of all programmers and for assigning tasks. Without such management, the same program can be modified simultaneously in two different ways by two different programmers. This results in two versions of the same program. This configuration management function will require additional JSI staff time.

Configuration management includes written record-keeping of changes made to the code. This record-keeping includes

- name of program(s)
- programmer's name
- precise description of problem that was corrected (before and after) or enhancement that was made
- location in the menu system in which modifications will appear
- date of modification to program in development database
- date that change was installed in the operational database
- testing that was done

The testing should include a search (with UNIX "grep" command) through all of the NEWVERN code to identify other areas of the code which might be affected by the change.

Recommendation

48. JSI should develop configuration management procedures for controlling modifications to NEWVERN and making version releases.

4.2.3 Installation Procedures

No written installation procedures currently exist in one organized document. Written installation procedures need to include descriptions of the following:

- directory system where code should reside for both development and operational databases
- UNIX shell scripts
- listing of all PROGRESS procedures by directory
- UNIX file ownership and permission settings
- baseline data files and directions for loading
- PROPATH variable setting
- other essential directions for installing NEWVERN

These installation procedures should be technical in nature, describing each aspect of installation, and should not be simply to run an automated program.

Version releases of modifications and enhancements to NEWVERN should be scheduled two to four times per year. These version releases should be accompanied by written documentation describing each change. The contents of each version release (STRs and ECPs) should be agreed to by A.I.D. and JSI prior to programming a version release. Version releases should be delivered to A.I.D., along with documentation, for validation testing.

In order to keep track of when modifications are made to the operational NEWVERN database, only those programs which are changed, or which have include files that were changed, should get re-compiled with a new date stamp. Every time a program is compiled from source code into object code the current date and time is attached to it. This is used to identify when a program was last changed. Currently, *all* of the NEWVERN programs are re-compiled when a new version of NEWVERN is installed as the operational database. This has the effect of changing the dates on all programs, not just the ones that were modified. This reduces the ability for configuration management. With more than one person changing code, detailed and accurate documentation of

code changes becomes much more important. This documentation should keep track of the date and time that each program is changed.

Recommendation

49. JSI should develop written technical procedures for making a version release and for installing a NEWVERN database.

4.3 System Administration

4.3.1 Account (User) Management

The need for password protection of accounts was discussed above (see Section 4.1.5.1).

Recommendation

50. The JSI system administrator for the Altos CPU should monitor the /etc/passwd file to ensure that all accounts are password protected.

4.3.2 Backup Procedures

JSI currently backs up NEWVERN in two ways. The system administrator for JSI's Washington office is responsible for backing up the entire hard disk in the CPU every day. This backup is automated and occurs at 5:25 a.m. Once a week a backup tape is placed off-site in a safe deposit box. Two back-up tapes are rotated between JSI and the safe deposit box. Also, on a weekly basis a database manager for NEWVERN backs up the NEWVERN operational database and source code. If the system "crashes," recovery can be done through the previous day's work by using the nightly backup tape or through the previous week by using the database manager's weekly backup tape. If the CPU and the nightly backup tape at JSI are lost or destroyed, recovery can be done with the safe deposit tape through the previous week.

A.I.D. has no physical control of NEWVERN and is, therefore, vulnerable to loss of access to NEWVERN. The relationship between A.I.D. and JSI is excellent, but unforeseen events (such as a company sell-out) can produce unexpected change. It is simply sound business practice for the owner of any software to be in physical possession of a recent copy of the software. For A.I.D., this would include a copy on tape of NEWVERN source code, object code, baseline data files, UNIX shell scripts, a recent backup of the operational database, and any other related files for installing and operating the NEWVERN database.

Recommendation

51. A.I.D. should be in physical possession of a copy of the latest version of NEWVERN, including source code.

4.3.3 Archival Procedures

There are no archival procedures for NEWVERN. Archiving a computer system means selectively copying records from an active database onto a tape, then deleting those same records from the active

database. Archiving is done to reduce storage requirements. Archiving may also speed processing when tens of thousands of records accumulate in a database. Designing and programming an archiving system for NEWVERN would be time-consuming because of the complexity of the file relations. At this time, neither speed nor storage requirements require that NEWVERN records be archived. Archiving would be appropriately undertaken only after more important enhancements are completed.

Some records, such as orders, do get deleted from the system, without archiving, when they are cancelled. No records are deleted, however, simply because they are old. The PROGRESS specialist on the evaluation team did not have time to analyze the instances in which records are deleted, and, therefore, no recommendations are offered on this issue. It would be appropriate to evaluate record deletion when NEWVERN is fully tested and validated by A.I.D.

There are old baseline records in NEWVERN which reflect work prior to NEWVERN implementation. Some of these old records cause discrepancies in the database. Cleaning them up or deleting them may require decision making or changes in procedures by A.I.D. One example is the inventory records, which currently reflect negative inventory amounts because FPIA used inventory belonging to A.I.D.

Recommendation

52. Old records in NEWVERN, which reflect work prior to NEWVERN implementation and which cause data discrepancies, should be cleaned up or deleted. It is not recommended at this time that any archival programs be developed.

4.4 Quality Assurance

4.4.1 JSI Testing

Since JSI is the primary user as well as the developer of the software, testing occurs within JSI when changes are transferred to the operational database. With the addition of new programmers who will be modifying NEWVERN code, it is essential that all programmers follow established procedures when making code changes.

Recommendation

53. JSI should develop procedures for making code changes and for testing code. These procedures should include careful analysis of all NEWVERN code which might be affected by the code change(s). It should also include detailed documentation. (See Section 4.2.2.3 on management of source code and object code and Section 4.1.4.3, on validation, for a full discussion of edit checks and programs to test for data integrity.)

4.4.2 A.I.D. Testing

Initial software validation testing should result in detailed written descriptions of software problems and suggestions for software enhancements. This testing should take approximately three months.

Recommendation

54. A.I.D. should conduct software validation testing of NEWVERN. This testing should be conducted by a senior analyst and PROGRESS programmer. Future software changes and enhancements to NEWVERN should be similarly tested each time a new version is released.

4.4.3 NEWVERN Version Releases

From time to time, JSI updates the NEWVERN software with a new version incorporating many changes. In addition, JSI makes individual changes to the NEWVERN operational system as needed. Little or no documentation of changes is kept, nor does A.I.D. review the changes.

A.I.D. needs to exercise its responsibility to perform software validation testing. This is especially important because A.I.D. is not the primary user of NEWVERN. Thus, without A.I.D. testing there is no way to know if corrections and enhancements to NEWVERN have been satisfactorily completed.

Recommendations

55. A standard format should be developed for recording software trouble reports (STR) and engineering change proposals (ECP). (See Section 4.1.2.2 on STRs and ECPs.)
56. A.I.D., in consultation with JSI, should prioritize the STRs and ECPs and schedule them for completion with a targeted version release date.
57. Each version release should be accompanied with detailed documentation. A.I.D. should conduct testing of each release based on the documentation which describes each change that was made. Corrections should be made by JSI until A.I.D. certifies acceptance (i.e., completion) of all STRs and ECPs included in the release.

4.5 Technical Documentation

In order to institutionalize software, detailed technical documentation is necessary. This is especially true if very few people understand the design of the software and if the software is intended to be used for a number of years. NEWVERN is an integral part of the FPLM program, and it can be anticipated that NEWVERN will be used for as long as A.I.D. supports the purchase and distribution of contraceptive commodities overseas. Currently, only one person fully understands the design of

NEWVERN. One other person maintains code related to the CPTs. One new programmer is in training to support NEWVERN.

JSI has developed a well-written and organized technical reference manual, which contains the following: a list and brief description of each PROGRESS procedure; description of each file, field, and primary index; summaries of the 16 subsystems which constitute NEWVERN; and a print-out of the NEWVERN data dictionary. The technical documentation that exists is excellent and represents many hours of effort; however, additional documentation is required to make it complete.

Recommendation

58. NEWVERN should be fully documented so that it can be supported by others when and if the current developer makes a career change. A completion date should be identified for this documentation and the documentation should be considered a "deliverable" to A.I.D. in the same way that program modifications are.

4.5.1 Data Dictionary

For each file, the data dictionary describes the file name, file description, indexes, record deletion validation check, and fields within the file. For each field within each file, the data dictionary describes the field name, field label, data type, format, initial value, validation criteria, whether the field is case-sensitive, whether the field is mandatory, whether the field participates in an index, and whether the field is a view component. For each file, indexes have been created which speed up the sorting of records (e.g., sort shipments by customer code, then by shipment date starting with most recent, then by status.) For each index of each file, the data dictionary describes the index name, the primary index which makes a record unique, the field-name components of the index, and whether the index should sort records in ascending or descending order. PROGRESS also allows a user to access and read the data dictionary on-line. Users with permission to access the NEWVERN maintenance menu can then access the data dictionary.

4.5.2 File Relations

Thorough documentation of the file structure will reduce maintenance efforts for new JSI staff and will enable A.I.D. users, trained in Query PROGRESS,⁶ to write simple ad hoc programs.

The NEWVERN file structure is documented, but could be improved. Although it is true that PROGRESS code can be read and analyzed by other PROGRESS programmers, and that the code itself serves as a certain type of documentation, there are certain kinds of technical documentation which can greatly reduce maintenance and enhancement efforts by reducing the analysis time required to understand NEWVERN. Understanding the file structure is essential to understanding the design and workings of the software.

⁶PROGRESS commands that allow an end-user to write his or her own programs to access data without changing the data.

Recommendation

59. File relations should be described both textually and graphically. The graphic illustration should consist of a large wall-sized map of the file structure showing (1) direction of relationship (one-to-many), (2) whether the relationship is always required or optional, and (3) the key field(s) which form the relationships. The textual documentation should describe the same three things as the file structure map, and should also describe the conditions or rules governing each file relation. The file structure documentation should refer to fields by *both* field labels and field names. Referring to the field label, such as "Quantity Received," improves the readability of the documentation. Referring to the corresponding field name in parentheses, such as (shipment.s_amt_r), is required, especially when changes to the code are required.

(For a fuller discussion, see Section 4.1.4 on technical design features and data integrity and Section 4.1.6.1 on naming conventions for fields, variables, files, and procedures.)

4.5.3 Menu Map

There is no menu map for NEWVERN, nor a separate section in the user's manuals containing all the menus. In addition to the file structure documentation, the other most helpful type of technical documentation is a menu map, which should, also, be documented both textually (menu-by-menu) and graphically on a wall-sized menu map. A documented menu map allows users and developers to communicate more easily when discussing the location of a screen or process within NEWVERN. When documenting STRs or ECPs it is necessary to identify the precise location being referred to within NEWVERN. The menu map provides the necessary tool. As part of the process of developing a menu map, it is recommended that the conceptual organization of the menus and naming of the selections be improved.

Recommendation

60. The NEWVERN menu system should be described both textually and graphically in a wall-sized menu map. Prior to this documentation, the menu design should be improved (see Section 4.1.3.6 on menu design).

4.5.4 PROGRESS Procedures

The technical reference manual provides an excellent summary overview of what each procedure does and helps the user to understand the business procedures that NEWVERN automates. Generally, when this documentation refers to files and fields, the labels are used instead of the technical names. For example, "attribution" is used to refer to the "attrib" file. The documentation refers to "amendments," but the data dictionary does not list any file name resembling "amendment." In a relational database, records that the user refers to, such as an order, might actually be composed of two or more related files, such as an order header (orderhd) and individual order lines (orderln).

Another example comes from the NEWVERN technical reference manual: "All attributions should have a total amount greater than zero." When referring to the data dictionary for the technical field name of the "total amount," one discovers that two different fields hold total amounts: "at_total" and "at_used." The field "at_total" contains the total amount of the attribution. The field "at_used" contains the amount of the attribution which has been spent to date. There is insufficient documentation to determine whether "total amount" refers to "at_total" or to "at_used."

When the existing technical documentation refers to files and fields without providing the technical names as used in the data dictionary, then the documentation lacks enough *technical* detail to be used by an analyst or programmer.

Recommendation

61. Technical documentation should refer to file and field names *technically*, as well as with their labels. Also, technical documentation should describe step-by-step (i.e., block-by-block) processing within each PROGRESS procedure.⁷ This documentation preferably would be internal to the code, but could be provided in the technical reference manual. (See Section 4.1.6.1 on naming conventions for fields, variables, files, and procedures and Section 4.1.6.6 on programming standards for internal documentation.)

4.5.5 Called Procedures and Include Files

The technical documentation does not include a centralized listing of procedures that are called or included with another procedure. Technical documentation is necessary, when making code changes, to understand how procedures are tied together and to ascertain the impact on the code when a change is made. For example, when making a change to a program named "look_def.i," a programmer must check every location in the software where that program is invoked and then test all occurrences after the change is made.

Because written documentation should never be relied upon as being up-to-date, it is important that there be a UNIX shell script or PROGRESS program which will generate all "run" statements and "include files" or just selected ones.

Recommendation

62. On-line documentation should be developed to identify all procedures that are called with the PROGRESS "run" statement or used as "include files." A printed listing of this documentation should also be included in the technical documentation for use by analysts.

4.5.6 Directory Structure and Procedures Listing

The current documentation lists procedures by conceptual modules, called "subsystems" by JSI. This is extremely helpful. Documentation that lists which programs exist under which directory is also

⁷The term "procedure" is synonymous with "computer program."

necessary for installing NEWVERN and for understanding the software development environment.

Recommendation

63. Technical documentation should be developed to describe the UNIX directory system for NEWVERN (including full UNIX pathnames) and listings of all procedures which should be listed under each directory.

4.5.7 Electronic Data Transfer Specifications

Electronic data transfers occur between the freight forwarder's (Matrix) database on an as-needed basis, approximately once or twice a week. When Matrix enters data into its database, it transfers the data electronically (uploads) to NEWVERN and also downloads data from NEWVERN. A CPT database is also developed in the field with USAID missions. Some of these data are entered into NEWVERN electronically and some are entered manually. No technical documentation of this process was provided by JSI during this evaluation. Complete technical documentation should include technical specifications which describe the files being transferred; the end-of-field, end-of-record, and end-of-file designators; the data fields; and their data type, length, and content.

Recommendation

64. The technical specifications for electronic data transfers to and from other databases should be included as part of the technical documentation.

4.5.8 Installation and Version Release Procedures

See Section 4.2.3 on installation procedures for a discussion of the components of documentation for these procedures.

Recommendation

65. Installation procedures and version release procedures should be documented.

4.5.9 Hardware Environment

There is at present no documentation of NEWVERN's hardware environment. Documentation of the hardware environment would include a list of hardware, serial numbers, current use, ownership (funds under which purchase was made), physical location, as well as networks, modems, and modem telephone numbers.

Recommendation

66. All hardware used by NEWVERN should be identified and networks described in the technical reference manual. Modem phone numbers may be kept separately for security purposes.

4.5.10 Internal Code Documentation

More internal documentation would increase the readability of the code. See Section 4.1.6.2 on programming standards for block headers and end statements; Section 4.1.4.1 on structured programming; and Section 4.1.6.6 on internal documentation.

Recommendation

67. More internal code documentation, especially at the block-header level, should be used.

4.5.11 Software Trouble Reports and Engineering Change Proposals

As discussed in Section 4.1.2.2, written STRs and ECPs are the organizing tools for performing software maintenance and enhancements. These written documents are not currently produced under the FPLM II contract. Their development would allow both A.I.D. and JSI to better manage limited resources and do more precise scheduling of work. STRs and ECPs would provide one of the key measurements for A.I.D. to monitor the contractor's completion of tasks throughout the life of the contract. In addition, through this mechanism, A.I.D. can have a better means of clarifying and expressing its needs and requests to the contractor.

Recommendation

68. Both JSI and A.I.D. should maintain a notebook containing detailed descriptions of all software trouble reports and engineering change proposals, along with the status of each. (See Section 4.1.2.2 on software trouble reports and engineering change proposals and Appendix B for STR and ECP examples.)

4.5.12 Correspondence between A.I.D. and JSI

A central correspondence file for the FPLM I and II contracts does not exist. Because of the size and diversity of the FPLM contract, this lack of centralized written communications allows for requests, suggestions, promises, and problem issues to slip between the cracks. An historical record would enhance continuity, particularly when there is staff turnover either within JSI or A.I.D.

Recommendation

69. Both JSI and A.I.D. should maintain a notebook of all correspondence between the two parties regarding FPLM/NEWVERN.

4.6 User Documentation

Currently, two NEWVERN user's manuals exist. One manual provides step-by-step procedures for data entry. It also has a section which shows the required approval processes and paperwork flow within JSI and between JSI and A.I.D. The other manual provides instructions for printing NEWVERN reports, along with sample pages of each report. Time did not permit the testing of the

user's manuals for accuracy or completeness. Several additions to these manuals are recommended along with more documentation on the screen to alleviate users' reluctance to look information up in a manual. Although much of the information which is recommended to be added already exists in the user's manuals, it is not easy to locate. Organizing some of this information in separate sections would help users locate what they need with much greater speed.

User documentation in the software industry is generally divided into two types: reference manuals and instructional manuals. Instructional manuals provide a new or infrequent user with step-by-step directions for learning and using the software. Reference manuals provide a quick look-up for technical information, not usually memorized, for trained users. The current NEWVERN user's manuals are more instructional in nature. Recommendations for additional documentation for quick reference are described below.

4.6.1 On-Line Documentation

Very little on-line documentation of NEWVERN exists beyond simple one-line help messages and error messages. The F2 help key is only partially implemented. For a discussion of these issues refer to Section 4.1.3.2 on help messages; Section 4.1.3.3 on error messages; and Section 4.1.3.4 on on-line documentation.

Recommendation

70. More user documentation should be included on-line so that the user can get immediate assistance by reading explanations on the screen without having to refer to written user's manuals.

4.6.2 Keyboard Use

Certain function keys are used throughout NEWVERN. For example, pressing F1 makes a process run or enters data into a field. Pressing F4 exits a user from a process without saving changes. Function keys are described in the user's manual. These keys are not always used consistently within NEWVERN, however. For example, when selecting a printer, the F4 key does not allow the user to exit without changing the printer. Instead, the F4 key produces an endless loop, forcing the user to make a new selection in order to exit. In addition, both written and on-line documentation explain that the use of the PAGE-UP and PAGE-DOWN keys will scan through available record codes, such as countries or order numbers. The use of the PAGE-UP and PAGE-DOWN keys are not yet implemented throughout NEWVERN, even though the documentation directs the user to press them to scan records.

Recommendation

71. The use of function keys within NEWVERN should be consistent in all places with the written and on-line documentation.

4.6.3 Menu System

NEWVERN menus are currently scattered throughout the user's manuals. Many submenus are not included in the user's manuals. Recent modifications to NEWVERN menus are not reflected in the

written documentation. The addition of a separate section in the user's manual which lists all NEWVERN menus would help users locate particular functions with greater speed.

Recommendation

72. A separate section in the user's manual should provide an overview of the NEWVERN menu system. Each menu should be printed on a separate page. In the top right-hand corner, the menu selection path for finding a submenu should be listed. Additionally, a menu map of NEWVERN should be developed in wall-chart form (see Section 4.5.3 for a description of a menu map).

4.6.4 Reports

Currently, there is no on-line description of reports nor is there a table of contents in the user's manual which lists report names, report summary descriptions, and user's manual page numbers. A user must leaf through many pages searching for the desired report. Without on-line descriptions of each report, it is difficult to locate a desired report. This is particularly problematic because many reports cannot be viewed on the screen, but can only be printed. A.I.D. staff report such difficulty in locating information which they desire, that they usually resort to calling JSI and asking JSI to locate the information they want.

Recommendation

73. A table of contents should be included with the user's manual which describes NEWVERN reports so that users can quickly locate the report they want. Report descriptions should always describe the following three items: record selection criteria, sorting method, and data to be displayed. Reports should also be described on-line.

4.6.5 Lists of Codes and Abbreviations

Currently, data entry is described throughout the two user's manuals. There is no centralized location which describes acceptable data forms. For example, lists of country codes, customer codes, recipient codes, product codes, etc., are not included. Also, the design format of fields does not describe key fields which the user must enter, such as an order number. Without knowing this information, a new or infrequent user cannot work his or her way through the NEWVERN screens without getting "stuck" because he or she does not know the correct form of the data to be entered. Such an additional section describing codes and acceptable field entries would be especially useful for persons performing testing of NEWVERN. Acceptable data entry forms could also be provided on-line by pressing the F2 (help) key. NEWVERN has implemented this F2 key in some, but not all instances.

Recommendation

74. A separate section should be included in the user's manual which provides all necessary codes, abbreviations, and acceptable field entries for NEWVERN data entry.

4.6.6 Overview of Responsibility

At present, the user's manual does not describe who performs which NEWVERN functions according to what schedule. Certain functions are performed daily, others weekly, monthly, annually, or on an as-needed basis. Many steps are performed in certain sequences; that is, one step must precede another step. This schedule of *who* does *what*, *when* would help users understand how to operate NEWVERN.

Recommendation

75. A separate section should be included in the user's manual which gives an overview of work responsibilities.

4.6.7 Automated Processing versus Data Entry

Current documentation explains to the user how to perform data entry, but does not explain what processes will be automatically carried out by the computer and are, therefore, not required to be done by the user. The user needs to know what processes are fully automated even if he or she does not have to perform any work. For example, the user should never be left to wonder whether records are deleted, totals are updated, or dates are changed. In other words, when the operator performs step A, documentation should describe that the computer performs step B.

Recommendation

76. User documentation should be developed to explain steps that the computer performs when triggered by menu selections or data entry performed by the user. This documentation should inform the user of the consequences of his or her action.

5. Summary Recommendations

Previous Page Blank

5. Summary Recommendations

JSI has handled the development of NEWVERN in a responsible and cost-effective manner. All software development is a trade-off between getting a workable system *now* versus getting a *perfect* system sometime in the future. JSI made the correct decision in getting the software operational before all the bugs were worked out. This is the *standard* approach in all software development projects. Correcting problems with the software and adding enhancements occurs in the life cycle development of software. That is why the concept of version releases is used. Each version incorporates some software "fixes" as well as new features.

NEWVERN development has now reached the stage at which the user base should be expanded. The preceding sections of this report contain many detailed recommendations to increase the usefulness of NEWVERN through improved management and software development procedures. The following recommendations summarize those made throughout the report.

5.1 Exercise Closer Management over NEWVERN

A.I.D. should exercise closer management over NEWVERN software development and maintenance in order to take greater advantage of NEWVERN's potential.

To achieve this, A.I.D. should identify a full-time manager/analyst with technical skills to manage the MIS aspects of the FPLM contract. This person should receive training in Query PROGRESS and should be the central contact person for A.I.D. staff and the liaison to JSI. A.I.D. should assume greater responsibility for identifying its needs and managing the MIS tasks conducted by JSI. A manager/analyst should devote a large portion of time to analyzing areas in which procedures can be streamlined, paperwork can be further reduced through on-line approval procedures, and managers can be better informed through NEWVERN on-line reporting.

A standing design review committee should hold meetings as often as necessary to participate in the clarification and prioritization of modifications to NEWVERN. Population program specialists, budget specialists, and PROGRESS analysts and programmers should participate in design review meetings on an as-needed basis when agenda items require their input. Programming modifications should not occur until design issues have been clarified and approved.

5.2 Conduct Software Validation testing

A.I.D. should conduct software validation testing of NEWVERN.

This testing, which would take approximately three months, should be done by a senior-level analyst and PROGRESS specialist. It should examine NEWVERN screens, source code, data integrity, file relations, and design of the data dictionary. It should result in detailed, technical written descriptions of software problems which require modifications and recommendations for enhancements and changes to NEWVERN.

A.I.D. should not attempt to maintain a PROGRESS specialist as a full-time employee. So long as NEWVERN continues to be under development (with new enhancements being made to the software), software development should not be turned over to A.I.D. If and when new development to NEWVERN ceases and the software is considered to be totally tested and working properly, and therefore, static, A.I.D. might re-evaluate whether it can keep a PROGRESS programmer on staff to take over maintenance of NEWVERN in-house.

5.3 Use Software Trouble Reports and Engineering Change Proposals

Software problems identified through testing or usage and requests for software changes or enhancements should be written down and clarified by an analyst in precise technical detail.

A standard form should be used for software trouble reports and engineering change proposals. Each STR and ECP should be assigned a number and its status tracked from unscheduled, scheduled, in development, tested, and completed (i.e., accepted by A.I.D.). The use of written STRs and ECPs is the *essential* organizing tool for clarifying requests, prioritizing, budgeting, scheduling, and testing software modifications, as well as measuring contract performance.

5.4 Adhere to Schedules for Version Releases

Both JSI and A.I.D. should make written contractual commitments describing the content and scheduled completion dates of periodic software releases. Both organizations should work according to long-range plans and schedules and refrain from requesting and responding to unscheduled rush jobs.

It is anticipated that the software validation test (see Section 5.2 above) will result in 100 or more STRs and ECPs. The A.I.D. manager/analyst with primary MIS responsibility for NEWVERN (see 5.1 above) should develop a schedule, in consultation with JSI, for regular NEWVERN version releases. Delivery dates of version releases for A.I.D. testing should be established, preferably on a quarterly basis.

The exact content of each version release should be identified by listing STRs and ECPs to be included. The delivery of each version release should include documentation describing each modification, as well as corrections to both the technical reference manual and the user's manuals. The quantity of STRs and ECPs to be included in each version release should be calculated based on estimates of time requirements for programming each STR and ECP and available programmer person days. Time for software testing and corrections should be built into the schedule. JSI should make assignments to programmers based on this schedule and the list of STRs and ECPs. Both A.I.D. and JSI should be committed to sticking to a schedule and should handle new work requests on a long-term planning basis rather than as weekly rush jobs which disrupt JSI's schedule. A.I.D. should monitor completion of all JSI NEWVERN tasks and should continue to have a PROGRESS specialist test the software after each version release.

5.5 Reduce Paperwork and Work Redundancy

NEWVERN should provide improved on-line administrative review and approval procedures to reduce the paperwork shuffle between A.I.D. and JSI.

A distinction between *job* redundancy and *work* redundancy must be made. *Job* redundancy means more than one person has the knowledge and ability to perform a job. This is desirable. *Work* redundancy means that the same work gets done by more than one person. Work redundancy exists between JSI and A.I.D. because of the manner in which approval processes are implemented. A.I.D. does much of the approval process with paper, then JSI duplicates it with the computer. The method of giving approval should be redefined and automated.

Since the computer has hundreds of edit checks programmed into it, some of the paper-level approval process is redundant. The rules programmed into NEWVERN represent an implicit approval process. If the rules have been approved, it should not be necessary to approve each application of a rule. This work redundancy should be eliminated by putting the approval and review process on-line. For this to occur, better on-line reporting which allows managers to monitor work and respond to exception reports is required.

5.6 Improve Management Reporting

NEWVERN information should be made available to a wider range of users, including the Office of Financial Management and CPSD program managers, through more and better on-line reports.

NEWVERN should be developed so that A.I.D. managers can rely more heavily upon it for financial management, logistical planning, and monitoring of workload and resource requirements. The design of existing reports should be analyzed and modified to increase readability. Improved on-line reporting capabilities should allow A.I.D. and JSI users to see reports on the screen without having to print them. Users should be able to customize reports by indicating multiple selection criteria, such as date range, country, product, status, etc.

5.7 Improve NEWVERN User-Friendliness

The user-friendliness of NEWVERN should be improved to increase its usefulness and decrease training and support requirements.

The NEWVERN menu system should be modified so that it is easier for users to locate processes and reports. The wording in menu selections should match the title of the resulting screen. More and better on-line help messages, error messages, and documentation of reports and procedures will greatly increase the user-friendliness of NEWVERN. Additional edit checks and corrections of problems identified during testing will eliminate the places in the software which frustrate users.

More and improved on-line documentation should be added to NEWVERN to reduce the learning curve and make it more user-friendly. Documentation should be added to the user's manuals to

include sections on the menu system, lists of necessary codes, and an overview of work responsibilities.

5.8 Improve Financial Accountability

NEWVERN account balances and inventory should be reconciled with those maintained by USAID missions and by the Office of Financial Management.

Records within NEWVERN should be reconciled by developing a "balance sheet" reflecting funding sources and expenditures. The handling of funded PIO/Cs should be modified to permit tracking by source of financing. A working relationship should be established between CPSD and the Office of Financial Management. NEWVERN's on-line capability should be used to simplify CPSD administrative approval of voucher payments. CPSD should establish control over NEWVERN/Matrix inventory adjustments. A.I.D. should strengthen the arrival acknowledgment and follow-up process of commodities shipped to field recipients.

5.9 Reduce Vulnerability through Improved Documentation

JSI should create additional technical documentation so that other analysts and programmers can work with NEWVERN.

JSI should describe more fully the file relations, menu system, UNIX directory system for NEWVERN, installation instructions, description of required baseline data files, data transfer specifications, and version release procedures. Technical file names and field names should be included when writing technical documentation.

Appendices

Appendix A

Evaluation Background

Scope of Work

Evaluation Team Members

List of Documents Examined

List of Persons Interviewed

Appendix A

Evaluation Background

Scope of Work

EVALUATION OF THE NEWVERN CONTRACEPTIVE ACCOUNTING AND TRACKING SYSTEM

Under the Family Planning Logistics Management Project, the Office of Population has a contract with John Snow, Inc (JSI) to undertake two primary activities: 1) to provide logistics management assistance to developing country family planning programs; and 2) to provide technical support and management of R&D/POP's contraceptive accounting and tracking system (NEWVERN). This evaluation will focus exclusively on the NEWVERN system. It is important to have an external assessment of the NEWVERN system because of the central role it plays in substantiating the expenditure of millions of dollars annually, and documenting the flow of hundreds of millions of contraceptives to developing country family planning programs.

I. Basic Project Information

Project Name and Number	Family Planning Logistics Management (936-3038) II
Contract Number	DPE-3038-C-00-0046-00
Contract Value	\$20,000,753
Obligations to Date	\$8,101,000
Expenditures on NEWVERN	\$293,329

II. Purpose of the Evaluation

The purpose of the evaluation is to assess the design, accountability, and reliability of the NEWVERN contraceptive tracking system. NEWVERN is a computerized contraceptive management information system that documents the procurement, shipment, storage, and financial accounting of A.I.D. supplied contraceptives. In essence it is an order processing and billing system. NEWVERN is intended to help the Office of Population with the following tasks:

- 1) **manage** the contraceptive orders from A.I.D.-supported family planning organizations;
 - 2) **produce** the monthly production of contraceptives for
- 

seven manufacturers;

3) track the shipment of contraceptives from point of manufacturer (or the U.S. warehouse) to the recipient; and

4) maintain an up to date financial accounting of funds received for contraceptives from different parts of the Agency and expenditures in the form of contraceptive shipments to designated developing country recipients and cooperating agencies.

The evaluation of the NEWVERN system needs to focus on two interrelated, but conceptually distinct, tasks: 1) the overall quality, reliability, accountability, and documentation of the custom designed software; and 2) JSI's performance in managing the NEWVERN system and responding to A.I.D.'s needs for information from the system. The first task is a thorough examination of the capabilities workings of the software and its documentation. The second task is an assessment of how well JSI has managed and maintained the flow of information into and out of the NEWVERN system and whether the outputs from the system meet A.I.D.'s needs on a timely and reliable basis.

The evaluation team will also be asked to advise A.I.D. on whether, in the long run, the NEWVERN function should be retained as part of a larger technical assistance project in logistics management or transferred to A.I.D or a separate database management contract. In addition, the team will be asked to comment on whether there are any critical missing pieces to the NEWVERN system that either compromise the system or limit its utility. Finally, the evaluation team should comment on the future costs of maintaining and updating the system.

III. Background

A.I.D.'s population program is designed to enhance the freedom of couples in developing countries to choose voluntarily the number and spacing of their children. The provision of contraceptives is central to this effort, ensuring that local family planning organizations receive adequate stocks of contraceptives. Since 1982 A.I.D. has spent more than \$30 million annually for contraceptives, principally condoms, IUDS and oral contraceptives (OCs). In fiscal year 1990 alone, the Agency spent more than \$60 million for contraceptives and shipped more than 830 million condoms, six million IUDS, and 59 million OCs to over 75 developing countries. Since the late 1980s the NEWVERN database, developed and maintained by JSI, has been the Agency's primary vehicle for managing the supply of contraceptives to A.I.D. supported family planning programs.

Until the mid 1980s the financial and commodity tracking system was manual. In addition to the sheer number of transactions, the variety of funding sources being used to finance contraceptives

(e.g. DA, ESF, DFA), the need to be able to document financial obligations and expenditures by country, and the diversity of products (and product prices) being provided necessitated the development of a computerized financial and commodity tracking system. The NEWVERN database is the Agency's primary vehicle for tracking and documenting the flow of funds and contraceptives associated with the A.I.D.'s population assistance program.

In 1989 The Inspector General conducted a thorough audit of the Agency's contraceptive procurement operation. One of the IG's recommendations was that the funding (and accounting) system used to finance centrally procured contraceptives be improved. In response, R&D/POP established a central project that collects funds from all sources and against which the contraceptive contracts and related shipping and warehousing services are obligated and expended. The NEWVERN database serves as the central repository for all the financial data related to contraceptive obligations and expenditures. In essence NEWVERN is the Agency's surrogate financial accounting system for contraceptives.

The second major function of NEWVERN is to keep track of all orders for A.I.D.-supplied contraceptives and the resulting shipment of commodities to appropriate developing country recipients and Cooperating Agencies. Currently, the database is tracking orders for all A.I.D.-supported programs, and maintains an up to date record of all shipments to these recipients. In addition, NEWVERN is the only way A.I.D. can link the financial obligations and expenditures on each nine production contracts to each individual contraceptive order and shipment. The Agency's ability to account for the contraceptives it purchases and supplies is dependent on the accuracy, integrity and reliability of the NEWVERN software as well as JSI's management and maintenance of the database.

In 1986, JSI under their first FPLM contract (1986-1990) began development of the computerized NEWVERN system. NEWVERN is a custom designed software package written in the PROGRESS language under the UNIX operating system. It consists of multiple subsystems, the most important of which are: the background file maintenance system, the (contraceptive) contract system, the customer and recipient system, the funding system, the (contraceptive) warehouse system, the freight forwarding system, the ordering system, the shipment tracking system, the security and data integrity systems.

Through these subsystems, NEWVERN tracks: estimates of contraceptives needed by country and product; funding requirements and funds received by source; commodity orders and desired shipment schedules; contraceptive production schedules; warehouse stocks; and shipment status. In terms of outputs, the NEWVERN database generates monthly cables to missions on shipment schedules and quarterly statements of account balance, production instructions to each contraceptive manufacturer, and shipping

instructions to A.I.D.'s freight forwarder.

The NEWVERN database currently contains information on over 3,000 contraceptive orders, over 5,000 shipments to more than 60 developing countries, and related financial information. There are about 500 fields in 53 files, and the entire package takes up about 10 megabytes of space. The PROGRESS based software is fully multi-user, and contains over 50,000 lines of code in approximately 500 procedures. The accompanying documentation is between 300 to 400 pages; about evenly divided between user and technical information.

Although NEWVERN has been in operation for several years, it is continually undergoing modifications and changes. But there has never been a comprehensive review or audit of the NEWVERN program to determine how well it meets the requirements of the Agency and how responsive JSI has been to the needs and requests of R&D/POP for information from NEWVERN. In addition, "closing the book" on the 1989 IG audit of the Agency's contraceptive program included an expanded role for NEWVERN especially in terms of financial accountability. Therefore, it is prudent for R&D/POP to conduct a thorough evaluation of the NEWVERN system and its management by JSI.

IV. Evaluation Questions

The evaluation will cover five topics:

1. the system design, controls and accountability;
2. the documentation of the system;
3. the accountability of NEWVERN;
4. the quality, accuracy and timeliness of the system inputs and outputs; and
5. future needs and directions.

In conducting the evaluation, the team should not only assess the NEWVERN software itself, but also JSI's management of the NEWVERN database.

1. **The System Design and its Internal Controls**

- a. What is the overall quality and efficiency of the NEWVERN software system? How modularized is the NEWVERN system? Is the design of each module appropriate to the task? Are there any major logical, mathematical, or accounting errors in the programming code that undermine the integrity of NEWVERN? Does the software have all the "little things"

that make a program user friendly - e.g. help facilities, clear menus, capacity to back-up in routines etc.

- b. What is the quality of the internal edits and controls used by NEWVERN to ensure the integrity of the data? What data entry checks are used by JSI to maximize the accuracy of the data entered into NEWVERN?
- c. What types of protection exist to guard against loss of data either accidental or intentional? What types of safeguards exist to protect NEWVERN against computer viruses and other alien influences?
- d. How flexible is the NEWVERN software, and how flexible should it be to meet A.I.D.'s needs? How easy is it to modify the software to adapt to changes in A.I.D.'s accounting and reporting requirements?
- e. What degree of redundancy exists among JSI (and CDC) staff in terms of knowledge of the NEWVERN software? Does this redundancy in knowledge extend to programming NEWVERN? If there is limited redundancy how vulnerable is the Agency, and what can/should be done to alleviate this vulnerability within the terms of the JSI contract and the FPLM Project?
- f. How assessable is the NEWVERN database to R&D/POP staff, appropriate CAS (e.g Matrix, CDC, IPPF/WHR, etc)? How "user friendly" is NEWVERN, and what would be needed to improve its user interfaces? Has R&D/POP been kept up to date on enhancements or modifications to NEWVERN? IS R&D/POP routinely consulted prior to initiation of any major modification or enhancements? How much support does JSI provide to R&D/POP in ensuring our ability to readily access NEWVERN?
- g. How frequently is NEWVERN out of service, or unavailable to R&D/POP, because of updating or system breakdowns? Is this level of down-time reasonable? Have JSI staff been responsive in repairing NEWVERN service to R&D/POP?

2. Documentation of NEWVERN

- a. Is there a complete technical documentation of the NEWVERN software, both internal and external documentation? Does this technical documentation provide clear and adequate instructions to permit a programmer familiar with PROGRESS to understand and modify the NEWVERN code? Are the modifications/enhancements made by JSI to NEWVERN adequately documented?
- b. Is there adequate user-oriented documentation of NEWVERN? Is this documentation easy to understand and use by a non-programmer (e.g. by R&D/POP staff, JSI and CDC staff that

need to access the NEWVERN database)? Are there sufficient users-guides and manuals readily available to users? Are there sufficient on-line help facilities and menu instructions?

3. Accountability of NEWVERN

- a. As the financial accounting system that A.I.D. depends on for the details of contraceptive funding and expenditures, does NEWVERN satisfy all the Agency accounting requirements? Does it follow generally accepted accounting and financial procedures and definitions? Does NEWVERN adequately track the financial data by country and funding account? Is the NEWVERN financial tracking system in sync with the Agency's financial accounting and reporting requirements? Does NEWVERN adequately meet the needs of FM and mission controllers in terms of financial accountability? Is it necessary to be able to track financial obligations and expenditures separately by project or recipient for missions that provide contraceptive support to multiple recipients and/or through more than one project (e.g. Pakistan, Egypt, Bangladesh)?
- b. As a contraceptive ordering and tracking system, does NEWVERN provide an adequate record of the status of requests for contraceptives? What are the rules on changing shipment dates, quantities, funding sources, or identification numbers? Does NEWVERN routinely adjust the "funds reserved" accounts when actual shipment costs are available and if the initial cost estimate was too high is the difference promptly returned to the pool of non-reserved funds? Does NEWVERN "flag" shipments whose shipping dates differ significantly (e.g. by two or more months) from the date requested in the order cable so that missions and recipients can be notified of the delay? Similarly, if shipment quantities differ from the quantities ordered are they "flagged" by NEWVERN?
- c. How well does NEWVERN meet the accountability requirements of its various constituencies (i.e. R&D/POP, FM, mission controllers, mission population officers, contraceptive suppliers, and the contraceptive freight forwarder)? How accessible is NEWVERN to R&D/POP staff? Are missions and recipients routinely advised of significant changes in shipment dates, quantities, or funding sources that are made by NEWVERN?
- d. Has R&D/POP yielded to much or too little control over NEWVERN and its operation to JSI? What degree of control over NEWVERN and its operation should be retained by R&D/POP? Does R&D/POP need to create a system for periodically monitoring the quality and accuracy of NEWVERN outputs? If so, what should be included in this monitoring,

how frequently should it be done, and what are the resource implications for R&D/POP?

4. Quality, Accuracy, and Timeliness of NEWVERN DATA

- a. Is the necessary financial and commodity data entered in a timely and accurate manner? At what point does the financial and shipment data become final and no longer subject to repeated modifications?
- b. Is the information requested by A.I.D. (either on a regular or an ad hoc basis) provided in a timely and understandable manner? Does the NEWVERN system produce the data needed by the various customers in a timely fashion and in a format useful to the recipient? How responsive has JSI been to requests for information from NEWVERN that cannot be readily accessed by R&D/POP staff? Are the data outputs available to A.I.D. users in a convenient format and/or easily exportable (e.g. to Lotus files, files that can be easily accessed by other commonly used software such as Harvard Graphics or WordPerfect)?
- c. Do the current documents, reports, and cables produced by NEWVERN contain sufficient information for the intended audience? Are they produced in a timely and easily digestible fashion? What additional information should be routinely produced by NEWVERN?
- d. How does JSI allocate staff time to NEWVERN operations (e.g. data entry, system maintenance, programming enhancements, responding to data requests, documentation)? Does JSI allocate sufficient and appropriate staff to non-programming tasks such as data analysis, report preparation and responding to requests from A.I.D.? How responsive and timely has JSI been in making requested modifications to NEWVERN?

5. Future Needs and Directions

- a. What enhancements and modifications should be made to the NEWVERN software? What changes, if any, should be made in R&D/POP's and JSI's management of the NEWVERN operation?
- b. In the longer-term are the Office's and the Agency's needs for a centralized contraceptive MIS best served by housing the NEWVERN operation within a larger technical assistance project? What are the pros and cons of keeping the NEWVERN operation within a logistics management project that is responsible for assisting developing country family planning programs? What resources and steps would be required to transfer the NEWVERN system to another contractor or to A.I.D. at the end of this project?

- c. In what areas does A.I.D. remain vulnerable in its reliance on NEWVERN? What steps can and should R&D/POP take to reduce its vulnerability?

V. Composition of Evaluation Team

The evaluation team will consist of three people who, between them, have expertise in the following areas: Programming complex databases in the PROGRESS language; accounting and financial management and experience with A.I.D.'s financial system; and a family planning specialist with an understanding of A.I.D.'s population program. The level of effort for each area of expertise is estimated to be four to five weeks for the programmer, three weeks for the controller/financial analyst, and two to three weeks for the family planning specialist.

The evaluation is scheduled to take place in March and April 1992 with meetings scheduled in Washington, DC. While in Washington the team will meet with appropriate A.I.D., JSI and cooperating agency personnel and have access to project files, vouchers, computer programs including all source code and documentation, reports, and all other pertinent material. No international travel is envisioned, although the team may wish to interview by telephone or a cable survey appropriate A.I.D. field staff such as HPN officers and mission controllers. Little domestic travel is envisioned, although selected team members may wish to interview CDC staff who are familiar with NEWVERN. In addition, the team may wish to interview, by telephone, representatives of contraceptive manufacturer (who receive NEWVERN generated production orders).

VI. Reporting Requirements

A draft evaluation report will be due to A.I.D. no later than sixty days after the evaluation team commences work. The report, excluding annexes, should not exceed 75 pages and should include:

- a table of contents
- an executive summary giving a brief overview of the contract's objectives, the purpose of the evaluation, the major findings and recommendations;
- a statement of conclusions, findings, recommendations and vulnerabilities with supporting evidence for each of the conclusions;
- the body of the report should provide a full description of: 1) the purpose and major issues underlying the evaluation; 2) the team composition and evaluation methodology; 3) important findings, conclusions and recommendations, and 4) suggestions and

recommendations for future needs and directions.

- appendices, as needed, including evaluation scope of work, technical notes, lists of individuals interviewed and documents consulted, and dissenting views, etc.

At the time draft report is completed, the team will hold a debriefing on the major findings and recommendations for interested A.I.D. staff.

Within two weeks of receipt of the draft report, A.I.D. will provide written comments and corrections, and approximately two weeks later the final evaluation report will be due.

VI. Funding and Logistical Support

All funding and logistical support for the NEWVERN evaluation will be provided through the POPTECH project. This includes recruitment and payment of evaluation team members, support for all expenses related to the evaluation and publication of the final report.

Evaluation Team Members

Amy Beam

Amy Beam, Ed.D., has worked with the PROGRESS programming language (in which NEWVERN is written) since 1984, and was a founding member of the Board of Directors of the PROGRESS Users Group in the Mid-Atlantic region. Previous PROGRESS experience includes the development of software for the yellow-page advertising industry and the management of software development for U.S. Army procurement software used at 157 sites. Prior to beginning her career in software development, Beam was a school administrator and English teacher. Her understanding of the design of self-instructional materials guides her approach to developing user-friendly software for use by non-technical professionals. She was team leader and focused on examining the design and reliability of the NEWVERN software as well as management issues.

Betty Case

Betty Case has over 15 years of population program and budget experience. Prior to her retirement from A.I.D. in 1988, she was the senior program officer for the Office of Population. Previous assignments in A.I.D. as well as various consultancies have provided her with a background in and knowledge of budget, financial, and information analysis. These included work in the A.I.D. central Office of Planning and Budget with oversight of numerous central programs and appropriation accounts, assignments in the Office of Data Management with responsibility for A.I.D.'s Reports Management Program and analysis of information systems throughout A.I.D., and design of an automated project financial monitoring system for tracking project and funding information. Ms. Case examined the usefulness of NEWVERN information to various types of users.

Douglas Robbins

Douglas Robbins is a retired A.I.D. controller. His 20 years of work with A.I.D. was at both headquarters and overseas in positions in the financial management field. Domestic assignments included assistant agency controller for support services, regional controller for Africa, regional controller for Latin American and the Caribbean, and a detail to initiate operation of the Africa Development Foundation. He also worked in financial management positions in seven USAID missions. Prior to his experience with A.I.D., he worked in financial management for the Soil Conservation Service, the U.S. Coast Guard, the National Institutes of Health, and the Treasury Department. Robbins examined the NEWVERN system from a financial perspective with a special interest in accountability.

List of Documents Examined

- Attachment B, Scope of Work, and Attachment C, Work Statement, of the RFP for Family Planning Logistics Management II (936-3038).
- Award Contract to John Snow, Inc., for FPLM II (August 31, 1990).
- Midterm Evaluation of Family Planning Logistics Management Project*, May 19, 1989, Population Technical Assistance Project, Dual and Associates, Inc. and International Science and Technology Institute, Inc.
- An Overview of the Centrally Funded Contraceptive Procurement Project No. 936-3018, Audit Report No. 9-000-89-010, September 29, 1989*, from James B. Durnil, Inspector General's Office of Programs and Systems Audits.
- Evaluation of the Central Contraceptive Procurement Project (936-3018) Matrix International Logistics, Inc.*, September 27, 1991, Population Technical Assistance Project, Dual and Associates, Inc. and International Science and Technology Institute, Inc.
- Guide to the Office of Population, Agency for International Development 1992*, January 1992, prepared by Office of Population, Bureau for Research and Development, U.S. Agency for International Development.
- CPSD Central Systems Analysis, Draft 3, dated 6/19/87; FPLM's first cut at defining on paper the operations of the CPSD central office prior to NEWVERN.
- FPLM Memoranda; Meeting Notes of meetings between JSI and CPSD, 4/20/88 and 5/12/88; major action items and points of understanding regarding NEWVERN development.
- Action Memorandum for the Assistant Administrator, Bureau for Science and Technology; from S&T/POP, Duff G. Gillespie; subject: Authorization of the Central Contraceptive Procurement (936-3057) Project; May 25, 1990.
- Project Authorization for Central Contraceptive Procurement (936-3057), Richard E. Bissell, Assistant Administrator, Bureau for Science and Technology, A.I.D., May 29, 1990.
- Action Memorandum for the Assistant Administrator for Research and Development; from R&D/POP, Duff G. Gillespie; subject: Project Authorization Amendment for the Central Contraceptive Procurement (936-3057) Project; Feb. 7 1992.
- Attachment 1, Central Contraceptive Procurement Project (936-3057) Operating Procedures, revision of May 17, 1990 (undated, 4 pages).
- Memorandum to distribution, from S&T/POP/CPSD, Carl J. Hemmer; subject: IG Audit of Contraceptive Procurement: Establishment of Central Project to Handle OYB Funding and Accounting; June 1, 1990.
- A.I.D. Policy Paper, *Population Assistance*, September 1988, Bureau for Program and Policy Coordination, USAID.
- Memorandum to CPSD staff, from S&T/POP/CPSD, Carl J. Hemmer; subject: Application of Brooke Amendment to OYB Transfers for Contraceptive Procurement; January 23, 1991.

Memorandum to distribution, from S&T/POP/CPSD, Carl J. Hemmer; subject: Brooke Amendment: Finetuning of Its Application to Contraceptive Procurement; February 5, 1991.

Memorandum to USAID Controllers and USAID Population/Health Officers; from S&T/POP/CPSD, Carl J. Hemmer; subject: Attached "Statement of Contraceptive Account;" August 23, 1991.

***Population Technical Assistance Project Consultant Guidelines, May 1991;* Dual and Associates, Inc., and International Science and Technology Institute, Inc.**

John Snow, Inc.'s workplans for 1991 and 1992 for Central Commodity Management Assistance.

NEWVERN Technical Documentation Manual; front section dated Draft 1 - March 4, 1992; remaining sections undated.

NEWVERN User's Guide, Volume 1; Version 1.0; September 15, 1989.

NEWVERN User's Guide, Volume 2; undated.

NEWVERN reports and other outputs

List of Persons Interviewed

U.S. Agency for International Development

Bureau for Research and Development:

Office of Population, Commodity and Program Support Division

Carl Hemmer	Chief
John Crowley	Deputy Chief and Project Officer for the Logistics Management Project; CTO for the JSI FPLM Contract and CDC PASA; Regional Specialist for Asia/Near East
Mark Rilling	Quality Assurance; Shipping and Warehousing; CTO for the Condom and Matrix contracts; Regional Specialist for Latin America and Caribbean
Doris Anderson	CTO for IUDs, VFTs, NORPLANT contracts; Funding; CPTs; Regional Specialist for Western Africa
Bonita Blackburn	CTO for Orals contracts; AIDS Programs; CA Commodity Support; Regional Specialist for Eastern Africa
Carl Hawkins	AIDS Program

Office of Population, Family Planning Services Division

Charlotte Cromer	CTO, Contraceptive Social Marketing (SOMARC) Project
-------------------------	---

Office of Program

Elizabeth Roche	Chief, Program Review Division
Johnnie Holt	Program Analyst
Frankie McLean	Information Systems Analyst

Directorate for Finance and Administration:

Office of Budget

Kenneth Milow	Chief, Resource Planning and Analysis Branch, Program Budget Division
John Richter	Program Analyst

Office of Financial Management

Robert Bonnaffon	Chief, Accounting Division
Cecile Adams	Acting Chief, AID/W Project Branch
Raymond Dropik	Chief, Contract/Grant/LOC Payment Branch
Satwant Kumar	Voucher Examiner
William Lawrence	Chief, Document Control Branch

Office of Procurement

Thomas S. Bordone Chief, Procurement Branch, Contracts/Commodity Support Division

Regional Bureaus:

Glenn Cauvin Office of Development Planning, Bureau for Africa

**Robert Meehan Office of Development Planning and Programs, Bureau for Latin America
and the Caribbean**

Contractors

John Snow, Incorporated (Family Planning Logistics Management Project)

Richard Owens	Project Manager, FPLM
William Felling	CCM Manager and Developer of NEWVERN
Edward Wilson	CCM Programmer
Magda Rodenburg	Operations
Walt Romualdo	Operations/CPT Database Manager
Jonathan Moseley	CCM Programming (new employee)
Tony Silbert	PPD/NEWVERN Database Manager
Steve Scott	JSI Computer Center Manager

Matrix, International (Shipping and Warehousing)

Eleanor Fitzgerald Project Supervisor

Cooperating Agencies

**The Futures Group (SOMARC contract)
James Wise**

Appendix B

**Sample
Software Trouble Reports
and
Engineering Change Proposals**

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Menu selections do not match menu titles

TYPE: Engineering Change Proposal (ECP)

Software Trouble Report (STR)

high priority; affecting operation

incorrect data or inadequate processing

low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 18, 1992

LOCATION OF OCCURRENCE: This problem occurs throughout the NEWVERN menu system. A listing of all the existing menus is attached to this STR. The handwritten titles to the right of each menu selection indicate the title displayed on the next screen when the user chooses this menu selection.

DETAILED DESCRIPTION:

In numerous instances, when a user selects something from a menu, the title which appears on the next screen, does not match the selection. Following are a few examples:

When the user selects "Contract Data," the next screen displays the title of "Contract Administration."

When the user selects "Add/Update A CPT," the next screen displays the title of "Contraceptive Requirements Estimate."

When a user selects "Modify Other Essential Data," the next screen displays the title "CPT Menu."

There are three different menus (with different selections) with the same title of "CPT Menu."

When the user selects "Add/Update Contracts," the next screen displays the title "Updating Contracts."

When the user selects "Background Data," the next screen displays a menu without a title.

The inconsistency in naming menus and data entry screens causes confusion to the user. Additionally, the inconsistency makes it difficult to report the location of software problems or to ask for help over the phone. For example, if a user referred to the "CPT Menu," this could refer to three separate menus in NEWVERN.

Taken individually, the naming inconsistencies in NEWVERN are low-priority problems. However, there are enough instances that, taken collectively, these inconsistencies present a major problem to new or infrequent users trying to learn how to use NEWVERN. This creates a longer learning curve and results in AID users calling JSI for assistance in locating available data within NEWVERN.

SOLUTION:

Examine the entire NEWVERN menu system and make titles of all screens exactly correspond to their menu selections. Consider adding the word "Menu" to all menu selections which display another menu. For example, "System Administration" would be named "System Administration Menu." Consider listing all menu selections which invoke a process with titles beginning with a verb. For example, "Add/Update Contract." Use parallel construction in naming conventions. For example, do not use "Add/Update" in the menu selection, then "Updating" on the input screen.

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Fix Processing for "View '89 - '90 Use Estimates"

TYPE: Engineering Change Proposal (ECP)

Software Trouble Report (STR)

high priority; affecting operation

incorrect data or inadequate processing

low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 18, 1992

LOCATION OF OCCURRENCE: Main Menu, CPTs, Select a Central CPT Function,
View '89 - '90 Use Estimates

DETAILED DESCRIPTION:

When the user selects "View '89 - '90 Use Estimates," the user is prompted with:

Which Country?

If the user presses PAGE-UP or PAGE-DOWN, the country codes and country names appear, one at a time. If F1 or ENTER is pressed to accept a country and view its estimates, the user encounters an endless loop. The cursor remains in the country code field and the help message remains at the bottom of the screen: "Enter data or press END to end." The user may continue to scan through the countries with PAGE-UP or PAGE-DOWN, but pressing F1 and ENTER still creates an endless loop.

The only way to view the use estimates (an on-screen graph) is when the PROGRESS error message "*** Array subscript 7 is out of range. (26)," appears. (This error message is addressed in another STR.) When this message occurs, the user may press F4 then press F1 or the space bar to display the Use Estimates graph. The help messages are incorrect or non-existent.

SOLUTION:

The scoping of transactions needs work before this menu selection is usable.

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Problem printing Monthly Production Memos

TYPE: Engineering Change Proposal (ECP)

Software Trouble Report (STR)

high priority; affecting operation

incorrect data or inadequate processing

low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 18, 1992

LOCATION OF OCCURRENCE: Main Menu, Production Reports, Monthly Production Memos

DETAILED DESCRIPTION:

When the user selects "Monthly Production Memos," the user is presented with a data entry screen to select/enter the following fields: "Method Code," "Next Ship Date," "Report Type," "Recalculate Shipment Attributions," and "Produce 11-94s."

When the user selects a method code (CONDOMS) by pressing PAGE-UP or PAGE-DOWN, then presses F1 or ENTER for all of the other fields, the following PROGRESS error message is displayed:

***"ct_mem_p.p" was not found. (293)

Pressing F4 (end) takes the user to the PROGRESS editor. (Yikes!) Most users will not know how to get out of the PROGRESS editor and re-enter the NEWVERN menu system.

SOLUTION:

This error message indicates that one process called another process to run. This called process is named "ct_mem_p.p"; however, the process (computer program) does not exist. When this occurs, the user gets kicked out of the NEWVERN menu system. Add the missing program so that processing is not interrupted.

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Correct processing when finding customers of countries

TYPE: ___ Engineering Change Proposal (ECP)

Software Trouble Report (STR)
 ___ high priority; affecting operation
 incorrect data or inadequate processing
 ___ low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 20, 1992

LOCATION OF OCCURRENCE: Main Menu, Production Reports, Shipment/Charge Cables

DETAILED DESCRIPTION:

When the user selects "Shipment/Charge Cables," the user is prompted to enter a "Country Number." If F1 is pressed when first encountering the data entry screen to enter a country number, "000 USA" appears. If this country is selected by pressing F1 or ENTER, the following PROGRESS error message is displayed:

** Index value matches more than one customer. (139)

SOLUTION:

PROGRESS error message #139 indicates incorrect PROGRESS code. The relationship between the country file and the customer file is one to many; i.e., one country can have many customers. This error message indicates that more than one customer was found for the selected country and the PROGRESS code does not handle this situation. The PROGRESS code is expecting to find only one customer for one country, not multiple customers.

This is a serious problem and was seen to occur in other places in NEWVERN. Identify all occurrences in NEWVERN where customers of countries are looked up and correct the code to respond correctly when more than one customer record is found for a country record.

To find customers of countries, use the following code:

```
for each country:
  for each customer where
    integer(substring(customer.cu_code,1,3))= country.cy_num:
      display country.cy_num customer.cu_code. /* or other action */
    end. /* customer */
end. /* country */
```

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Sort Contracts by Date

TYPE: Engineering Change Proposal (ECP)

- Software Trouble Report (STR)
 - high priority; affecting operation
 - incorrect data or inadequate processing
 - low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 16, 1992

LOCATION OF OCCURRENCE: Main Menu, Contract Data, Add/Update Contracts

DETAILED DESCRIPTION:

When scrolling through contracts with page-up and page-down keys, the contracts are not sorted by date. The contracts are sorted either by ascending order (page-down) of the contract number or by descending order (page-up) of the contract number. In theory, this would allow the user to scroll through contracts from the most recent to the oldest (or vice versa) -- a very useful way to find and manage work-in-progress.

However, because of the design of the contract number, contract records are not actually sorted by date. The contract number has two numerical parts separated with a decimal point.

Example: 81036.92

Two digits to the right of the decimal point indicate a year. The digits to the left of the number identify a unique contract for the given year. In the example above, for 1992. However, the series of digits to the left of the decimal can be re-used with each year.

Example: 81036.89
81036.90
81036.91
81036.92

Each of the contract numbers in the above example represents a different contract. Therefore, when contracts get sorted using the contract number field, the digits after the decimal are recognized as fractions of a whole number, *not* as years.

Example: 71657.84
71635.85
71635.84
66667.92
66667.91
66667.89
66666.90
56681.84
50332.91

In the above example, contracts from different years are mixed together instead of first being sorted by year (the two-digit extension to the right of the decimal), and *then* sorted by the contract number to the left of the

decimal point. To correctly sort contracts by date, the contract numbers in the above example would be sorted as follows.

Example: 66667.92
 66667.91
 50332.91
 66666.90
 66667.89
 71635.85
 71657.84
 71635.84
 56681.84

SOLUTION:

Redesign the method of sorting contracts by date. There are at least three ways to achieve this. Each method has strengths and drawbacks.

Method 1:

Create a two-field index for sorting. Sort first by date, using another date field, such as "start date." Sort second by the contract number field. Creating an index will speed processing, but will require more storage space on the hard disk. If the number of contracts in the database is small, this storage requirement will be trivial. Having to sort by a two-field index rather than one field will make it harder for a user to write ad hoc queries to view contract data.

Method 2:

Use the Progress "substring" function to look at just a portion of the contract number field for sorting. In this case, first sort contracts by the last two digits (the year), then sort contracts by the first five digits. Further analysis would be needed to determine which method (1 or 2) would produce faster processing speed. This method would not be feasible for an end-user to use for writing ad hoc queries.

Method 3:

Redesign the contract number so that it begins with the year, rather than ends with the year. Thus 50332.92 would become 9250332. When the year, 92, is placed at the beginning of the number, the decimal point is no longer necessary. The change to the contract number on an active database would require careful analysis and programming to achieve data conversion from the old numbering system to a new numbering system. The benefit of redesigning the contract number to begin with the year is that it makes it immensely easier for an end-user to write a simple one- or two-line program to query the data base; specifically to examine contracts sorted by date. A redesign of the contract number might also eliminate the need for some of the other date fields which currently exist. The drawback of this redesign, is that it would take much more effort than either method 1 or 2, and may be too complex to be feasible.

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Set status codes automatically

NUMBER: ECP-021

TYPE: Engineering Change Proposal (ECP)

- Software Trouble Report (STR)
 - high priority; affecting operation
 - incorrect data or inadequate processing
 - low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 29, 1992

LOCATION OF OCCURRENCE: all locations of code where st_code is set or updated

DETAILED DESCRIPTION:

A status code is used throughout NEWVERN to track shipments. Each shipment record stores a status code in the status field (shipment.st_code). The available NEWVERN statuses are listed in the master "stat" file. There are only 9 different statuses. They are:

C	canceled	0
F	forward	0
L	lost	0
T	transfer	0
P	planned	1
M	scheduled	2
O	ordered	3
S	shipped	4
R	received	5

The numbers in the right column indicate the sequence of the statuses. According to this schema, a status of R (received) is the highest status a shipment can have, indicating it has been completely processed. The status code is used in dozens of places in NEWVERN (perhaps as many as one hundred times). It is essential that the status code be correct at all times.

Internal status codes which are set by the computer are integral to the design of order processing systems. Actions are taken based upon the status of records. In order to ensure the integrity of each status setting, the user is normally not permitted to set the status. Instead, some activity performed by the user, such as posting a quantity received, triggers the computer to change the status.

Examination of the NEWVERN source code reveals that an operator is permitted to set the status code through a data entry screen. This occurs in the PROGRESS procedure "cptrplsh.p". Whenever a user is allowed to change a status code, the possibility of introducing error into the database occurs.

In NEWVERN, the shipment file has a field for entering the date that a shipment is received (shipment.s_rec_dt). When the user enters this date, this data entry activity should trigger the system to change the shipment status from "S" for "shipped" to "R" for "received." Instead, the user is permitted to change the status code directly, regardless of whether a shipment has been reported as having been received. Analysis of shipment records with a status of "R" for "received," shows hundreds of records with no date of receipt.

The design of the database does not ensure the posting of received goods. This analysis is confirmed by interviews conducted with A.I.D. staff.

SOLUTION:

Search through all lines of NEWVERN code for the occurrence of "st_code." Modify the logic of how all status codes are set throughout NEWVERN. To ensure data integrity, never permit an operator to set the status code. Have the status code be set logically by the computer, based upon an activity which changes the status. In order to achieve this, A.I.D./JSI must enforce the use of two-way memos or modify the way in which missions are required to acknowledge receipt of goods.



NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Add help function to "Adjust Inventory"

TYPE: X Engineering Change Proposal (ECP)

- Software Trouble Report (STR)
 - high priority; affecting operation
 - incorrect data or inadequate processing
 - low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 18, 1992

LOCATION OF OCCURRENCE: Main Menu, Maintenance, Adjust Inventory Records

DETAILED DESCRIPTION:

In the "Adjust Inventory" data entry screen, the user is prompted to enter an amount:

Adjustment Amount: _____

If the amount entered is not a zero or a multiple of a full case lot, the user is prevented from proceeding and is given the following message:

"Adjustment must be full case(s); can't reduce remaining below 0."

Neither F2 (help) nor the message at the bottom of the screen gives the user the quantity in a full case, so the user is stuck and cannot proceed with data entry. Also, if zero (0) is entered in the "Adjustment Amount" field, it is accepted as valid.

SOLUTION:

Use the F2 or the message line to display the quantity in a full case. Check with the user/client to see if zero should be allowed as a valid entry.

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Eliminate PROGRESS error messages in "Shipment/Charge Cables"

TYPE: Engineering Change Proposal (ECP)

Software Trouble Report (STR)

high priority; affecting operation

incorrect data or inadequate processing

low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 20, 1992

LOCATION OF OCCURRENCE: Main Menu, Production Reports, Shipment/Charge Cables

DETAILED DESCRIPTION:

When the user selects "Shipment/Charge Cables," the user is prompted to enter a "Country Number." The PAGE-UP and PAGE-DOWN keys will scan through country numbers and display the country name to the right of the number. Three different PROGRESS error messages were encountered, depending upon which country was selected.

1. Nearly all country numbers, when selected, give the following PROGRESS error message:

** Customer record not on file. (138)

2. When some countries, such as "388 Bangladesh," are selected, the top half of a report is displayed on the screen. The following PROGRESS error message is displayed:

** This frame uses rows 1 to 36 but maximum row is 21. (108)

3. If F1 is pressed when first encountering the data entry screen to enter a country number, "000 USA" appears. If this country is selected by pressing F1 or ENTER, the following PROGRESS error message is displayed:

** Index value matches more than one customer. (139)

(NOTE: This problem is addressed in a separate STR.)

4. When some countries, such as "534 Barbados" and "511 Bolivia" are selected, the screen remains blank, and the user is prompted to enter a country number. No report is displayed.

SOLUTION:

1. PROGRESS error message #138 indicates that either an expected customer for the selected country is not in the database or the PROGRESS code is incorrectly written to identify the correct customer(s) for the country. If the former is true, then substitute a "user-friendly" help message to inform the user of the situation. Since the user was prompted for a country number, the current error message which states that the customer is not on file conveys no meaning to the user. If the latter situation is true, correct the PROGRESS code to correctly look up customers of a country. To find customers of countries, use the following code:

```
for each country:
  for each customer where
    integer(substring(customer.cu_code,1,3)) = country.cy_num:
      display country.cy_num customer.cu_code. /* or other action */
    end. /* customer */
  end. /* country */
```

2. PROGRESS error message #108 indicates this report has not been formatted to display on a terminal. Until the report is reformatted, display the error message

"This report is too wide to display on your screen. It must be printed."
The correct solution is to reformat the report to display on the screen.

3. In response to item 3, above, see STR entitled "Correct processing when finding customers of countries."

4. In response to item 4, above, if no report (cable, data, whatever) is available, provide a message to the user. Never display a blank screen without feedback to the user. The program worked, but why wasn't anything displayed?

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Incorrect or incomplete data for "Method Code" causes Progress error

TYPE: Engineering Change Proposal (ECP)

Software Trouble Report (STR)

high priority; affecting operation

incorrect data or inadequate processing

low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 18, 1992

LOCATION OF OCCURRENCE: Main Menu, Production Reports, Historical Production Memos

DETAILED DESCRIPTION:

When the user selects menu option "Historical Production Memos," the user is prompted to enter "Method Code." By pressing PAGE-UP or PAGE-DOWN, the user can scan existing methods. "CONDOS" appears as a choice. If CONDOS is selected as a method by pressing F1, the following PROGRESS error message appears:

**** FIND FIRST/LAST failed for file contract (565).**

SOLUTION:

Possibly this is a problem with the FIND statement. Check the code to see that "no-error" is included with the FIND statement and followed by an "If not available contract...then..." statement.

Do not rely on PROGRESS error messages as feed-back to the user. They always begin with two asterisks and end with a number inside parentheses.

Check the validation on all data entry screens for the "Method Code" field. How did bad or insufficient data get entered into NEWVERN which would cause this PROGRESS error?

Find and correct all incorrect or incomplete data in the operational database after the program correction is made and installed.

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Leave Help Screen of "Adjust Existing Attributions"

TYPE: Engineering Change Proposal (ECP)

Software Trouble Report (STR)

high priority; affecting operation

incorrect data or inadequate processing

low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 16, 1992

LOCATION OF OCCURRENCE: Main Menu, Contract Data, Adjust Existing Attributions

DETAILED DESCRIPTION:

The menu selection "Adjust Existing Attributions" prompts the user to enter a contract number. If F2 (help) is pressed before entering a contract number, there is no way to get out of the help window and enter a contract number. When the user first presses F2, a pop-up window explains how to enter a number and tells the user to use PAGE-UP and PAGE-DOWN keys to scan the available contracts.

The page-up and page-down keys do not work. Instead, the computer beeps each time either key is struck. Pressing F4 (exit) returns the user to the Contract Administration menu instead of the data entry screen, and the user must re-select "Adjust Existing Attributions."

If the user tries to enter a contract number after pressing F2, only one digit can be entered, then the computer just beeps when other keys are struck. The user *must* press F4 to exit.

SOLUTION:

Correct the transaction scoping so that when the user strikes F4 to exit from the help screen, the cursor is returned to the data entry screen (to enter a contract number) rather than to the Contract Administration menu.

Make the page-up and page-down keys work so that the user can scan through the existing contract numbers. Examine this help screen and paging function in all other occurrences in NEWVERN to be certain the problem is corrected wherever it occurs.

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Allow Change to Contracts without Change to Secondary Screens

TYPE: ___ Engineering Change Proposal (ECP)

- Software Trouble Report (STR)
- high priority; affecting operation
 - incorrect data or inadequate processing
 - low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 16, 1992

LOCATION OF OCCURRENCE: Main Menu, Contract Data, Add/Update Contracts, Updating Contracts

DETAILED DESCRIPTION:

The "Updating Contracts" screen does not display data correctly. Either the data must be displayed accurately, or the F4 (exit) key must end the transaction processing differently. The problem occurs when the following steps are taken:

1. User presses F1 (run) to enter/accept the contract number displayed in the "Contract #" field.
2. User changes data in the first data entry screen of the contract, then presses F1.
3. System prompts user: "Update information for this contract?" and user types "y" for "yes."
4. A secondary data entry screen appears for the item number of the contract.
5. User changes his/her mind and decides *not* to change item data and, instead, presses F4 (exit) to return to the previous "Updating Contracts" screen.
6. When the user presses F4, in the above step, the "Updating Contracts" screen is re-displayed *with the changed data*. The cursor is on the "Contract #" field.

At this point, the user sees that his changes are being displayed and may press F4 to exit this contract or may press page-up or page-down to display a different contract.

THE PROBLEM is that the user believes his changes to the contract have been made because they are displayed on the screen. In actuality, when the user presses F4 to exit from the item number screen (the second data entry screen), the changes on the first data entry screen are *undone* in the system, but not displayed correctly on the screen. The user leaves this contract, believing his changes have been made, when in fact they have not been saved in the permanent record.

SOLUTION:

This problem can be corrected in one of two ways. The correct solution depends on an analysis of what the user *wants and needs* the system to do.

Method 1: Appropriate messages can be displayed on the bottom two message lines of the primary data entry screen for contracts: "Changes have not been saved." and the contract record must be re-displayed with the correct (unchanged) data. That is, if the changes are undone and not saved, then the original data must be re-displayed.

Method 2: The user can be allowed to press F4 and exit from the item number screen (second data entry screen), return to the first data entry screen, "Updating Contracts," and have the original changes *saved* rather

than not saved. When the user exits from this contract, a status message should be display: "Contract saved with changes."

The issue of where to return the cursor to and what changes to save or delete when a user presses F4 (exit) is referred to in PROGRESS as "scoping transactions." Proper scoping depends on understanding how the user wants the system to respond at any given point. In this case, when the user exits the item screen without making changes to it, does the user also want to delete the changes made on the first screen or to save them? This design issue should be reviewed with the end-user.

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Provide help for "Customer Code" field

TYPE: Engineering Change Proposal (ECP)

- Software Trouble Report (STR)
 - high priority; affecting operation
 - incorrect data or inadequate processing
 - low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 18, 1992

LOCATION OF OCCURRENCE: Main Menu, Reports, Financial Reports,
Single Statement of Contraceptive Account

DETAILED DESCRIPTION:

When the user selects "Single Statement of Contraceptive Account," the user is presented with a data entry screen to enter:

Country:	___
Customer Code:	___
Current Period Start:	__/__/
Current Period End:	__/__/

When the user presses F2 (help) while the cursor is in the "Customer Code" field, a help window appears. The help tells the user to use PAGE-UP and PAGE-DOWN to scan the list of existing customers. These keys do not work; instead, when they are pressed, the terminal beeps. The help also tells the user to press F5 to add a new customer. The F5 key does not allow a new customer to be added; instead, when F5 is pressed, the terminal beeps.

SOLUTION:

Modify the code so that PAGE-UP and PAGE-DOWN keys work. Identify all other occurrences in NEWVERN where these keys are supposed to scan through the list of existing customers. Correct all occurrences where the keys do not work.

Allow the user to add a new customer to the database when the F5 key is pressed. Until this is programmed, change the help message to advise the user that he must first enter this new customer through the appropriate menu selection (name the menu). One would guess the customer file would be listed in the "Background Data" menu, but the User Manual does not list it in that menu.

106

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Validate data in inventory records

TYPE: Engineering Change Proposal (ECP)

Software Trouble Report (STR)
 high priority; affecting operation
 incorrect data or inadequate processing
 low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 23, 1992

LOCATION OF OCCURRENCE: records in "inv" field; identified through ad hoc test program

DETAILED DESCRIPTION:

Issue 1:

Of six warehouse records in the "whse" file, only one (000-MWHS) is active (whse.w_active = yes). However, remaining inventory is stored in an inactive warehouse (000-FWHS; whse.w_active = no). The inventory record is also flagged as being inactive (inv.in_active = no).

Example of an inactive inventory record with remaining stock in an inactive warehouse:

Inventory # (inv.in_num) = 35
Amount Remaining (inv.in_remain) = 336,000
Active (inv.in_active) = no
Warehouse (inv.r_code) = 000-FWHS

How can an inventory record showing remaining stock > 0 be flagged as being inactive?

Issue 2:

Active inv records with remaining amounts > 0 are in inactive warehouses. Examples of such are inventory #s: 481, 517, 518, 526, and more.

How can NEWVERN allow an active inventory to be located in an inactive warehouse?

Issue 3:

Many inventory records are active (inv.in_active = yes) and located in inactive warehouses (whse.r_active = no). The amount remaining for each of these inventory records is zero (0). Examples of inventory records are inventory #s: 340, 712, 439, 459, and more.

Why wasn't the active status (inv.in_active = yes) changed to inactive status (inv.in_active = no) when a zero amount was reached (inv.in_remain <= 0)?

Issue 4:

In some inventory records (inv file), the amount remaining (inv.in_remain) is a negative number, and the inventory record is inactive (inv.in_active = no). Negative amounts cause a PROGRESS error message to

be displayed because this negative number cannot be displayed in the field because of how it is formatted in the data dictionary. Examples of inventory records are inventory #: 2, 3, 33, 79, 281, 30, 363.

Why does NEWVERN allow negative amounts to be carried in the inventory file and what does this mean? How do negative amounts occur and how are they handled? Do negative amounts indicate errors in the data and/or in the PROGRESS code?

SOLUTION:

Examine the file relation between "whse" and "inv" and the data in the Active (inv.in_active and whse.r_active) and Amount Remaining (inv.in_remain) fields. The following PROGRESS code will display these records:

```
for each inv:
    find whse of inv.
    display whse.r_code
        whse.in_active
        inv.r_code
        inv.in_num
        inv.in_active
        inv.in_remain.
end.
```

Analyze this data and determine how the active status is used throughout NEWVERN and how negative amounts remaining occur and should be handled. If negative amounts can occur, re-format the inv.in_remain field to display negative amounts.

The data dictionary does not validate the active status of an "inv" record against the active status of the "whse" record. Correct this if required to maintain data integrity. Check the include file "inv_del.v" to see if validation occurs there. Does validation occur only during data entry from the keyboard or, also, when the amount remaining is calculated by the computer?

After any necessary code changes or dictionary changes are made, correct data in the "inv" records and "whse" records in the operational database.

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Allow negative amounts to be stored in inventory file

TYPE: ___ Engineering Change Proposal (ECP)

Software Trouble Report (STR)

___ high priority; affecting operation

incorrect data or inadequate processing

___ low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 21, 1992

LOCATION OF OCCURRENCE: The "Amount Remaining" field in the inventory file (inv.in_remain)

DETAILED DESCRIPTION:

The in_remain field, labeled "Amount Remaining," in the "inv" file is not formatted to allow a negative number to be stored. When writing an ad hoc program to display each inv record, the following PROGRESS error messages are displayed:

Inv. #2:** value -55200 cannot be displayed using >>>,>>>,>>9. (74)

Inv. #3** value -631200 cannot be displayed using >>>,>>>,>>9. (74)

Inv. #5** value -122400 cannot be displayed using >>>,>>>,>>9. (74)

This makes it impossible for a user to write an ad hoc report or query with this field. If it is formatted like this in the NEWVERN code, it will create a similar error.

SOLUTION:

Check all occurrences in NEWVERN where the field inv.in_remain is displayed. Reformat the field in the display statement if necessary. Reformat the field in the data dictionary after planning a data dump and reload (if necessary in PROGRESS version 6.0).

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Add edit check to Shipment Reports

TYPE: ___ Engineering Change Proposal (ECP)

Software Trouble Report (STR)

___ high priority; affecting operation

incorrect data or inadequate processing

___ low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 18, 1992

LOCATION OF OCCURRENCE: Main Menu, Reports, Contract/Warehouse Shipment Reports, Net Shipment Reports and, also, Warehouse Shipment Reports

DETAILED DESCRIPTION:

When the user selects either the "Net Shipments Reports" or the "Warehouse Shipment Reports," the user is prompted to enter the "Method Code," the "Starting Date," and the "Method." If the user fails to enter a date, the following PROGRESS error message appears:

** "?" was not found. (293)

SOLUTION:

An edit check should be added to the "Starting Date" field to guarantee that the user enters a date within an acceptable date range (if there are restrictions). If the user fails to enter a date, an error message should be displayed:

"A starting date must be entered. Please re-try."

If the date entered does not meet the edit check for an acceptable date range, an error message should be displayed. For example:

"Starting date must be"

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Display two-way memo on screen

TYPE: Engineering Change Proposal (ECP)

Software Trouble Report (STR)

high priority; affecting operation

incorrect data or inadequate processing

low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 18, 1992

LOCATION OF OCCURRENCE: Main Menu, Production Reports, Two Way Memos, Produce a Single Two Way Memo

DETAILED DESCRIPTION:

When "terminal" is selected as the printer output location, the two-way memo report cannot be displayed on the screen. PROGRESS displays the error messages:

** Frame uses columns 1 to 149, but max column is 80. (109)

** This frame uses rows 1 to 65 but maximum row is 21. (108)

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Validation required for Country Code

TYPE: Engineering Change Proposal (ECP)

Software Trouble Report (STR)
 high priority; affecting operation
 incorrect data or inadequate processing
 low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 18, 1992

LOCATION OF OCCURRENCE: Main Menu, CPTs, Select a Central CPT Function,
View '89 - '90 Use Estimates

DETAILED DESCRIPTION:

When the user selects "View '89 -'90 Use Estimates," the user is prompted with:

Which country?

If F1 or ENTER is pressed, the country "000 USA" is displayed. The PROGRESS error messages appears:

**Array subscript 7 is out of range. (26)
**Unable to update cpts Field. (142)

These same error message also appear if the country "388 Bangladesh" is selected.

If F4 (end) is struck after the error messages appear, asterisks appear on the screen. These seem to be the points in the Use Estimates graph, but without the graph axis or labels. These asterisks appear inconsistently after F4 is struck (depending on whether it is the first or second time F4 is struck), indicating a problem with scoping the transaction.

SOLUTION:

The program needs to be studied and corrected; especially examine the scoping of the transactions (processing on END statements).

Locate and validate all data entry occurrences of the "Country Code" field in NEWVERN. Determine whether "000" should be allowed as a valid country code.

Correct existing incorrect data in the operational database which may have been entered prior to the software correction.

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Allow Exit with F4 from Printer Selection Routine

TYPE: Engineering Change Proposal (ECP)

Software Trouble Report (STR)
 high priority; affecting operation
 incorrect data or inadequate processing
 low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 16, 1992

LOCATION OF OCCURRENCE: Main Menu, System Administration, Contract Data, Contract Administration screen

DETAILED DESCRIPTION:

On the "Contract Administration" screen, when the user presses F10 to select a new printer, he cannot exit from the printer selection screen with the F4 (exit) key. When F4 is hit, it produces an endless loop. When this happens, to return to the Contract Administration screen, the user must press F5 twice, then F1. This process changes the printer default to "terminal." The printer is de-selected. There are no on-screen directions; thus the user could get trapped here and require assistance.

If the user scrolls with the highlight bar through the printer names, then decides to leave the selected printer unchanged, but has forgotten what printer was selected, there is no way to exit without making a change/selection. The user must select a printer.

SOLUTION:

The user should be allowed to exit from the printer selection process with an F4. Help messages should be provided which explain how to select a printer (F1 or ENTER), or to exit without making changes (F4) or to exit and abandon any changes already made (F4). Since the F4 key is the standard key to exit a process without making or saving changes, it should work consistently throughout NEWVERN.

NEWVERN SOFTWARE REPORT

SOFTWARE ISSUE: Add menu title to "Background Data" menu

TYPE: Engineering Change Proposal (ECP)

- Software Trouble Report (STR)
- high priority; affecting operation
 - incorrect data or inadequate processing
 - low priority; improve user-friendliness

REPORTED BY: Amy Beam, POPTECH evaluation team

DATE: March 16, 1992

LOCATION OF OCCURRENCE: Main Menu, Background Data

DETAILED DESCRIPTION:

When the "Background Data" menu is selected, the menu which is displayed is missing a menu title.

SOLUTION:

Put a title on all menus. In this instance, put the title "Background Data" on the menu.

Appendix C

Survey of USAID Missions

Survey Questionnaire

List of USAID Missions Surveyed

Summary of Responses to Survey Questionnaire

Discussion of Responses to Survey Questionnaire

Appendix C

Survey of USAID Missions

Survey Questionnaire

NAME: _____ TITLE: _____ MISSION: _____

DIRECTIONS: Please circle your answers to the following questions based on a scale of 1 to 3, where:

1 means *ALWAYS*, 2 means *SOME OF THE TIME*, and 3 means *NEVER*

A. MONTHLY SHIPPING CABLE

- | | |
|---|-------|
| 1. Do you receive the Monthly Shipping Cable? | 1 2 3 |
| 2. Do you receive it in time to be useful? | 1 2 3 |
| 3. Is it used? (If <i>Never</i> , skip to #12) | 1 2 3 |
| 4. Is the information in it understandable? | 1 2 3 |
| 5. Does it meet your needs? | 1 2 3 |
| 6. Do you verify it with Mission records? (If <i>Never</i> , skip to #12) | 1 2 3 |
| 7. Does it accurately reflect Mission requests in terms of the following: | |
| a) shipment timing (+/- one month of requested date) | 1 2 3 |
| b) product ordered | 1 2 3 |
| c) quantities ordered | 1 2 3 |
| d) method of transport used | 1 2 3 |
| 8. If it is not accurate, is the problem reported? | 1 2 3 |
| 9. If reported, is there a response? (If <i>Never</i> , skip to #12) | 1 2 3 |
| 10. Does the response resolve the problem? | 1 2 3 |
| 11. Are responses timely? | 1 2 3 |
| 12. Does the Shipping Cable accurately estimate when an order arrives? | 1 2 3 |
| 13. Please add your general comments and suggestions for improvements: | |

B. QUARTERLY STATEMENT OF CONTRACEPTIVE ACCOUNT

- | | |
|---|-------|
| 1. Do you receive the Quarterly Statement of Contraceptive Account? | 1 2 3 |
| 2. Do you receive it in time to be useful? | 1 2 3 |
| 3. Is it used? (If <i>Never</i> , skip to #12) | 1 2 3 |
| 4. Is the information in it understandable? | 1 2 3 |
| 5. Does it meet your needs? | 1 2 3 |
| 6. Do you verify it with Mission records? (If <i>Never</i> , skip to #12) | 1 2 3 |
| 7. Does it accurately reflect Mission records in terms of the following: | |
| a) amount of Mission funding for contraceptives | 1 2 3 |
| b) contraceptives shipped per Mission request | 1 2 3 |
| c) remaining balance in Mission account | 1 2 3 |
| 8. If it is not accurate, is the problem reported? | 1 2 3 |
| 9. If reported, is there a response? (If <i>Never</i> , skip to #12) | 1 2 3 |
| 10. Does the response resolve the problem? | 1 2 3 |
| 11. Are responses timely? | 1 2 3 |
| 12. Would you like to receive written instructions on the Quarterly Statement of Contraceptive Account? | 1 2 3 |

13. Please add your general comments and suggestions for improvements:

C. SHIPMENT HISTORY REPORT

- 1. Do you receive the Shipment History Report? 1 2 3
- 2. Do you receive it in time to be useful? 1 2 3
- 3. Is it used? (If **Never**, skip to #12) 1 2 3
- 4. Is the information in it understandable? 1 2 3
- 5. Does it meet your needs? 1 2 3
- 6. Do you verify it with Mission records? (If **Never**, skip to #12) 1 2 3
- 7. Does it accurately reflect Mission records? 1 2 3
- 8. If it is not accurate, is the problem reported? 1 2 3
- 9. If reported, is there a response? (If **Never**, skip to #12) 1 2 3
- 10. Does the response resolve the problem? 1 2 3
- 11. Are responses timely? 1 2 3
- 12. Please add your general comments and suggestions for improvements:

D. TWO-WAY MEMOS

- 1. Do you receive the Two-way Memos? 1 2 3
- 2. Do you receive them in time to be useful? 1 2 3
- 3. Do you verify in-country receipt of the commodities listed on them? 1 2 3
- 4. Do you reply to them by signing and returning a copy to FPLM? 1 2 3
- 5. Do they meet your needs? 1 2 3
- 6. Is the information in them understandable? 1 2 3
- 7. Do discrepancies exist between what is received and what is listed on the Two-way Memo? 1 2 3
- 8. If discrepancies exist, do you report them to R&D/POP/CPSD? 1 2 3
- 9. If reported, is there a response? (If **Never**, skip to #12) 1 2 3
- 10. Do responses resolve the problem? 1 2 3
- 11. Are responses timely? 1 2 3
- 14. Is this a satisfactory method for you to notify A.I.D./W of shipment receipt? 1 2 3
- 15. Please add your general comments or suggestions for improvements:

E. RESPONSES TO AD HOC INQUIRIES

- 1. Do you make *ad hoc* inquiries to FPLM? (If **Never**, skip to F) 1 2 3
- 2. Do you receive responses to all your inquiries? 1 2 3
- 3. Are responses received in a timely manner? 1 2 3
- 4. Are the responses to your inquiries sufficient? 1 2 3
- 5. If responses have been insufficient, please explain:

1 means **ALWAYS**, 2 means **SOME OF THE TIME**, and 3 means **NEVER**

F. MISSION USE OF NEWVERN DOCUMENTS

Please place an X in front of the NEWVERN documents which you use to accomplish the following tasks:

- 1. Develop CPTs
 - _____ monthly shipping cable
 - _____ quarterly statement of account
 - _____ shipment history report
- 3. Monitor finances
 - _____ monthly shipping cable
 - _____ quarterly statement of account
 - _____ shipment history report

117

_____ two-way memos

_____ two-way memos

2. Order contraceptive commodities

- _____ monthly shipping cable
- _____ quarterly statement of account
- _____ shipment history report
- _____ two-way memos

4. Track shipments

- _____ monthly shipping cable
- _____ quarterly statement of account
- _____ shipment history report
- _____ two-way memos

G. GENERAL OBSERVATIONS AND COMMENTS

(Additional pages for detailed responses are welcome.)

1. How have the documents generated by NEWVERN affected your workload?

- _____ stream-lined my workload
- _____ added a burden to my workload
- _____ had little impact on my workload

2. To the best of your knowledge, during the last three years, has NEWVERN improved Mission handling of procurement, financial management and tracking of the shipment of contraceptives? Please explain.

3. Please explain in detail how any of these reports could be improved. Add comments and suggestions you may have for the NEWVERN system.

4. Are there additional services/reports that Missions desire from NEWVERN? If yes, please list.

R&D/POP appreciates Mission assistance in providing answers to these questions and any additional guidance given to evaluate NEWVERN. We hope to meet Mission needs effectively and efficiently and we appreciate your comments.

118-

Questionnaire for Controllers Only

NAME: _____ TITLE: _____ MISSION: _____

DIRECTIONS: Please circle your answers to questions 1 - 4 based on a scale of 1 to 3, where:

1 means *ALWAYS*, 2 means *SOME OF THE TIME*, and 3 means *NEVER*

H. FINANCIAL ISSUES

1. Does your Mission use funded PIO/Cs to purchase contraceptive commodities? 1 2 3
If YES, please answer the following questions. (Please return this questionnaire regardless of your answer.)
2. Do NEWVERN documents serve as a source of information for computing quarterly expenditures? 1 2 3
3. Do NEWVERN documents permit you to identify that portion of project disbursements which are not project expenditures on an accrual basis? 1 2 3
4. Could earlier transmittal of NEWVERN documents facilitate greater use of the documents as a financial management tool? 1 2 3
5. When funds from your Mission's PIO/C are used to finance contraceptive commodities shipped to another country or AID/W warehouse, what is your understanding of whose responsibility it is to:

a) verify receipt of those products?

b) authorize payment?
6. Does your Mission intend to continue to use the funded PIO/C mechanism in lieu of OYB transfers to finance contraceptive commodities? If yes, why? Please explain your particular situation.
7. Are there additional services and reports that Missions desire from NEWVERN? Additional pages for detailed responses are welcome.

R&D/POP appreciates Mission assistance in providing answers to these questions and any additional guidance given to evaluate NEWVERN. R&D/POP hopes to meet Mission needs effectively and efficiently and appreciates your comments.

List of USAID Missions Surveyed

Country

**Bangladesh
Brazil
Colombia
Costa Rica
Egypt
El Salvador
Ghana
Guatemala
Honduras
Kenya
Mexico
Nigeria
Pakistan
Peru
Philippines
Tanzania
Zimbabwe**

Summary of Responses to Survey Questionnaire

A. MONTHLY SHIPPING CABLE	<u>Always</u>	<u>Some of the Time</u>	<u>Never</u>
Do you receive the Monthly Shipping Cable?	9	2	
Do you receive it in time to be useful?	3	8	
Is it used?	6	5	
Is the information in it understandable?	11		
Does it meet your needs?	9	2	
Do you verify it with Mission records?	11		
Does it accurately reflect Mission requests in terms of:			
-shipment timing (+/- one month of requested date)	6	4	1
-product ordered	7	4	
-quantities ordered	8	3	
-method of transport used	10	1	
If it is not accurate, is the problem reported?	9	2	
If reported, is there a response?	6	4	
Does the response resolve the problem?	4	6	
Are responses timely?	2	7	
Does the cable accurately estimate when an order arrives?	2	8	

General comments and suggestions for improvement

Useful for tracking shipments ordered as a result of CPTs.

	<u>Always</u>	<u>Some of the Time</u>	<u>Never</u>
B. QUARTERLY STATEMENT OF CONTRACEPTIVE ACCOUNT (QSCA)			
Do you receive the QSCA?	3	5	3
Do you receive it in time to be useful?	2	5	2
Is it used?	8	2	
Is the information in it understandable?	4	3	
Does it meet your needs?	2	3	2
Do you verify it with Mission records?	7	1	
Does it accurately reflect Mission records in terms of the following:			
-Amount of Mission funding for contraceptives	6	1	
-contraceptives shipped per Mission request	5	2	
-Remaining balance in Mission account	5	11	
If it is not accurate, is the problem reported?	6	1	
If reported, is there a response?	2	3	2
Does the response resolve the problem?	1	3	1
Are responses timely?	3	2	1
Would you like to receive written instructions on the QSCA?	6	3	

Summary general comments and suggestions for improvement:

Long overdue

QSCA is seriously flawed. Masses several projects together, some of which have closed. Information on budget (OYB) missing, so we are always in the red.

This is very important to the mission and we never receive it.

Should include balance for each project.

	<u>Always</u>	<u>Some of the Time</u>	<u>Never</u>
C. SHIPMENT HISTORY REPORT			
Do you receive the Shipment History Report?	4	6	1
Do you receive it in time to be useful?	3	6	2
Is it used?	5	4	2
Is the information in it understandable?	7	2	
Does it meet your needs?	5	3	1
Do you verify it with Mission records?	5	4	
Does it accurately reflect Mission records?	2	7	
If it is not accurate, if the problem reported?	6	2	1
If reported, is there a response?	3	4	2
Does the response resolve the problem?	2	4	1
Are responses timely?	4	2	

Summary general comments and suggestions for improvement

Information is interesting, but not useful. Some projects have been closed for many years. No need to mix old and new together.

Time consuming; not sure what's the point.

Arrives one month late. It should arrive the month items are shipped.

Never used.

Used to cross check against mission records. If problems, AID response is satisfactory.

Useful to keep control of shipments ordered. Should be received at least quarterly.

Comprehensive shipment history would be helpful. Mission maintains own report by PIO/C number, NEWVERN Id, Bill of Lading, vessel, etc.

Should go back fewer years.

	<u>Always</u>	<u>Some of the Time</u>	<u>Never</u>
D. TWO-WAY MEMOS			
Do you receive the Two-Way Memos?	6	5	
Do you receive them in time to be useful?	3	6	2
Do you verify in-country receipt of the commodities listed on them?	11		
Do you reply to them by signing and returning a copy to JSI/FPLM?	8	3	
Do they meet your needs?	6	4	1
Is the information in them understandable?	10	1	
Do discrepancies exist between what is received and what is listed on the Two-Way Memo?	1	6	4
If discrepancies exist, do you report them to CPSD?	9	1	
If reported, is there a response?	5	4	1
Do responses resolve the problem?	4	5	
Are responses timely?	4	5	
Is this a satisfactory method for you to notify AID/W of shipment receipt?	8	1	

General comment or suggestions for improvement

Two-Way Memos are best part of NEWVERN.

Received long after recipient received shipment. Suggest memo be sent to mission with shipping documents and well before shipment arrives to allow recipient time to prepare clearance documents/funds for release of goods from customs.

More useful if recipient received them with a copy to the mission. The recipient could indicate when shipment arrives and return to JSI through the mission.

Sometimes does not provide Bill of Lading number and vessel name

Useful for them (JSI and CPSD), not us (Mission)

There is a lack of feedback from JSI regarding non-receipt of return copy of memo. (Note: Memos as forwarded to the implementing agencies and mission has not requested copies of their responses to JSI.)

124

	<u>Always</u>	<u>Some of the Time</u>	<u>Never</u>
E. RESPONSES TO AD HOC INQUIRIES			
Do you make ad hoc inquiries to CPSD?	4	7	
Do you receive responses to all your inquiries?	5	6	
Are responses received in a timely manner?	3	8	
Are responses to your inquiries sufficient?	3	6	

If responses have been insufficient, please explain:

CPSD is one of the most responsive offices in AID/W. Their support is outstanding.

Responses are sometimes not sufficiently clear and too late to meet mission's needs.

F. MISSION USE OF NEWVERN DOCUMENTS

	<u>Develop CPTS</u>	<u>Order Contrac Commod.</u>	<u>Monitor Finances</u>	<u>Track Shipmts</u>
Monthly Shipping Cables	4	4	4	10
Qtrly Statement of Account	4	2	5	0
Shipment History Report	6	7	6	7
Two-Way Memo	2	0	3	9

125

G. GENERAL OBSERVATIONS AND COMMENTS

How have documents generated by NEWVERN affected your workload?

Streamlined workload: 2

Added a burden to workload: 3

Had little impact on workload: 6

Summary observations and comments:

To the best of your knowledge, during the past three years, has NEWVERN improved Mission handling of procurement, financial management and tracking of the shipment of contraceptives?

Procurement via OYB transfer is simpler. Quarterly Statement of Account was long overdue.

NEWVERN system permits mission to keep better control over contraceptive procurement. Prior to NEWVERN mission had none of these documents to track shipments.

NEWVERN has improved some areas but made others more confusing.

Explain in detail how any of these reports could be improved. Add comments and suggestions for the NEWVERN system.

Shipment History could go back fewer years.

Reports could be improved if they were received in a timely manner.
NEWVERN should provide financial information on a monthly basis.

Add an additional copy of the Two-Way Memo for the mission or implementing agency.

Improve the Quarterly Statement of Account including segregation by source of funding and reconcile report for the quarter.

Are there additional services/reports that Missions desire from NEWVERN? If yes, please list.

On the whole, NEWVERN documents have been helpful.

Mission would like to receive financial statement of each project which finances contraceptives.

Status of funded PIO/Cs should be supplied regularly with the Quarterly Statement of Account report.

Discussion of Responses to Survey Questionnaire

Eleven missions (64 percent) responded to the survey. Overall, there is general satisfaction with the content of NEWVERN reports in terms of their usefulness and understandability. At least two areas noted as requiring improvement are worthy of serious consideration: (1) reporting on accounts should be done by project number and (2) the customer order document number should be added to the Monthly Shipping Cable. Both of these additions would greatly facilitate reconciliation of mission records with information in NEWVERN. Other problems identified appear to have more to do with the fact that several of the NEWVERN reports are relatively new and are not yet on schedule.

The majority of responding missions (6) indicated that NEWVERN documents have had little impact on their workload. Of the remaining five, two reported that the documents have streamlined the workload and three reported an added burden to workload. Once missions begin receiving these reports on a regular basis and become more familiar with the content and how to use the data some of the criticism may disappear. It would be useful if JSI were to compile a list of available NEWVERN reports/outputs with a brief description of content, purpose, distribution, and scheduling (e.g., monthly, quarterly, ad hoc).

The survey included four NEWVERN outputs which are routinely sent to missions: Monthly Shipping Cable, Quarterly Statement of Account, Shipment History Report, and Two-Way Memo.

Monthly Shipping Cable

The Monthly Shipping Cable details all shipments sent to a given country's recipients during the past six months and any shipments scheduled for the next three months (or up to the date through which production memos to manufacturers have been finalized). The cable is generated by NEWVERN from information in the database and is forwarded to CPSD for approval. Mission responses indicated that these cables are always understandable and used to verify mission records. The majority of respondents (an average of 70 percent) reported that information provided in the cable always reflected the mission's request in terms of shipment timing, product and quantities ordered, and method of transportation. Of the remainder, all but one responded "some of the time." Nearly all of the respondents reported that the cable is used to track shipments. One suggestion for improvement was that the mission ordering document number be included.

Statement of Contraceptive Account

The Statement of Contraceptive Account is the heart of the financial system of NEWVERN. This report provides the current status of a customer's (mission) account, including past and currently scheduled transactions. It is sent to all customers on a quarterly basis to permit them to review the status of their account and to resolve differences promptly. Mission responses regarding whether the report is used, meets their needs and is received in time to be useful were split about 50/50 between always and some of the time. Two of the missions responding reported that the statement had never been received. Several indicated that the statement would be more useful and less confusing if information was presented at the project, rather than mission, level. Mission records are kept by project and this change would greatly facilitate reconciliation of mission and NEWVERN records. Another suggestion was that information be broken out between the Population and AIDS programs; this would, of course, be taken care of if accounts were kept by project. Only two missions responded that the statement was always received in time to be useful. This probably accounts for the fact that fewer than one-half of the respondents use the statement to monitor finances. Since missions can use this information for their financial reporting, it would be helpful if it arrived on a regular basis and in time for their quarterly reporting.

Shipment History

Shipment History reports provide detailed information about all shipments, past and future. Of those who responded "always" or "some of the time" to questions regarding how well it meets their needs and whether or not it is useful, responses were divided about 50/50. Suggestions for improvement included making the report more comprehensive and reporting only on active projects.

Two-Way Memo

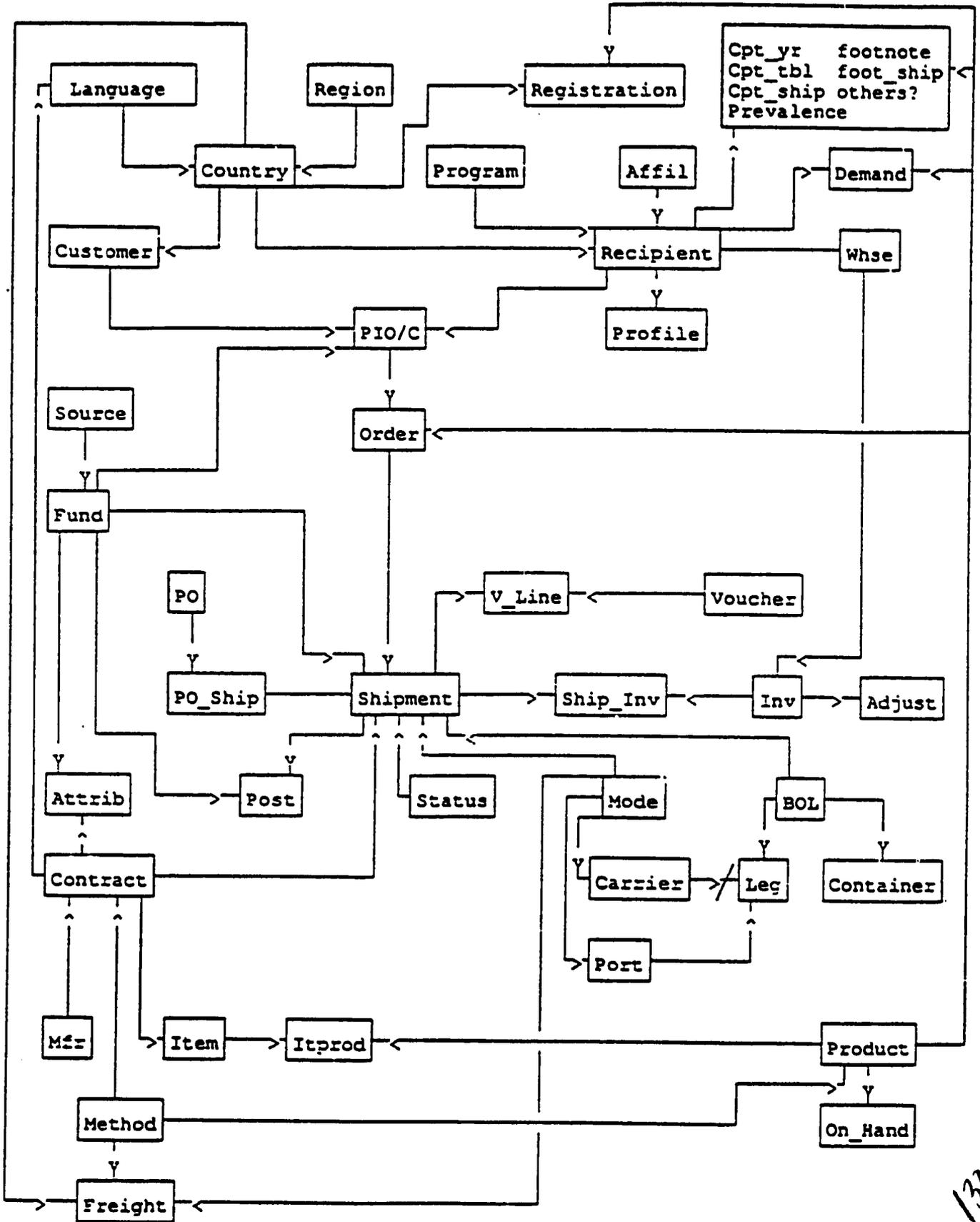
All USAID missions and Cooperating Agencies are requested to verify, in writing, receipt of all shipments sent out under NEWVERN. This is done by a two-way memo sent out by JSI accompanied by copies of shipping documents. The memo summarizes relevant details of a shipment and asks that the date and quantity received be verified. One mission reported that the two-way memo is the "best part of NEWVERN." Nine of the respondents indicated that the memo is used to track shipments. Suggestions for improvement included sending the memo directly to the recipient instead of the mission. The recipient could sign when product is received and return to JSI through the mission.

Appendix D

NEWVERN File Structure Map

Appendix D

NEWVERN File Structure Map



Appendix E
Recommendations

Appendix E

Recommendations

Project Management

Authority and Responsibility of A.I.D. and JSI

1. The CPSD administrative review and approval process should be automated to reduce paperwork and work redundancy.
2. The rules programmed within NEWVERN should be relied upon as part of the approval process. Also, better on-line reports, including exception reports, can help to achieve automation.

Staffing

Staffing within JSI

3. A clearer distinction should be made within JSI between staff resources allocated to operations and staff resources allocated to software development and maintenance. JSI NEWVERN programming staff should devote full-time effort to software development and remove themselves from daily operations.
4. Both A.I.D. and JSI should treat fewer requests as crises and strive toward a software development environment which prioritizes requests and implements them through scheduled software releases.

Staffing within CPSD

5. A position should be established within CPSD to manage the software development and maintenance of NEWVERN and other MIS components of the FPLM contract. The person selected for this position should identify and articulate to JSI what is needed by A.I.D. Also, this person must have enough technical expertise to understand those changes or enhancements recommended by JSI and other contractors.

Contractual Deliverables for NEWVERN

6. A.I.D. should clarify and increase the level of detail needed for JSI contractual reports to be useful. Clearer reports should relate level of effort to tasks completed.
7. With regard to NEWVERN development (not operations), A.I.D. should require JSI to submit in writing, for approval, a list with detailed descriptions of modifications and enhancements to be made to NEWVERN with quarterly completion dates.
8. The precise contents of each software release should be tested when work is completed (see Section 4.1.2.2 for recommended format). Written documentation should accompany each software release and should be considered a contractual deliverable.

Allocation of Time and Resources

9. The estimated amount of time that JSI should devote to NEWVERN and to PPD should be stated in the FPLM contract. A.I.D. should establish an internal procedure for resolving conflicts resulting from competing demands for limited JSI resources.

PROGRESS Programmers

10. JSI should seek to hire or groom a senior analyst and PROGRESS programmer. A.I.D. should recognize that the cost of such a technical specialist will be the same as that of a mid-level manager.

Implementation of NEWVERN

NEWVERN Accountability

Country Reconciliation

11. CPSD should complete the process of reconciliation between account balances kept by USAID missions and those kept by NEWVERN.

Expenditures

12. CPSD should establish an effective working relationship with the Office of Financial Management for development of expenditure information and obligation tracking.

Administrative Approval

13. NEWVERN's on-line capability should be used by CPSD to facilitate administrative approval of payment documents. If it is not currently possible to ascertain from NEWVERN when a shipment against a particular contract is received by Matrix, then this function should be added.

Inventory Adjustments

14. CPSD should implement a review and approval process for all inventory adjustments entered into NEWVERN, and should periodically obtain independent verification that the physical inventory in the warehouse is in agreement with NEWVERN records.

Acknowledgement of Receipt

15. The acknowledgment of receipt of shipments by recipients and the follow-up process should be strengthened. A formalized system should be put in place to (1) ensure that appropriate personnel are charged with responsibility for monitoring the actual receipt, (2) provide CPSD with sufficient information to follow up on shortages or incorrect commodity shipments with manufacturers and shippers, and (3) initiate corrective action when required.
16. NEWVERN should allow for the tracking of two different types of receipt of commodities: (1) receipt by the freight forwarder and (2) receipt by the in-country recipient.

Training

Training of JSI and CPSD Staff

17. An on-line, self-instructional training approach should be implemented by making NEWVERN more user-friendly and should include on-line documentation.

18. CPSD staff should make an effort to learn what information is available in NEWVERN and how to access it. JSI staff should use CPSD telephone inquiries as training opportunities.

Software Development and Maintenance of NEWVERN

Software Design Issues

Software Functions

Functional Document

19. A detailed list of automated functions handled by NEWVERN should be developed. Such a listing should be developed in conjunction with a review of the NEWVERN menu system (see Section 4.1.3.6 for a discussion and recommendation concerning improvement of the menu system). In addition, the list of functions in the current system should be developed to a more detailed level.

Future Development Needs

20. A separate list of functions yet to be automated should be developed to serve as a long-range planning guide for future NEWVERN enhancements. High priorities should include a financial tracking system that can be reliably used by the Office of Financial Management and CPSD. Also, more on-line reporting capabilities should be provided in order for CPSD to take advantage of the data already stored in NEWVERN and to automate the CPSD review and approval process.

Design Review Process

Input Procedures

21. More staff resources should be devoted to analysis and design issues and design review meetings should be held monthly or quarterly to clarify and prioritize design requests. The meetings should be attended by both software experts and A.I.D. program experts.
22. A.I.D. should determine and recommend changes to NEWVERN and not rely solely upon the contractor to determine what software modifications are required or desired. A.I.D. should advocate its own needs, provide more direction to JSI, and exercise more contract oversight.

Software Trouble Reports and Engineering Change Proposals

23. A formal procedure (including standard form for STRs and ECPs) should be developed for users at JSI, CPSD, the Office of Financial Management, missions, and CAs to report software problems and make requests for software enhancements or changes. Each enhancement request should be more fully developed and documented than is currently being done.

Prioritization and Scheduling

24. STRs and ECPs should be prioritized and scheduled in a written document agreed to by both JSI and A.I.D., and A.I.D. should monitor the timely completion of each task. Specific tasks should be documented in detail, analyzed by JSI to determine the necessary level of effort in

work days per task, and scheduled with target completion dates. Long-range planning, prioritization, and scheduling of tasks should be adhered to by both A.I.D. and JSI, and new requests should be handled routinely through design review meetings, rather than as emergencies. When A.I.D. makes new requests to JSI, JSI should make A.I.D. aware of how the NEWVERN design and programming schedule will be affected.

Functional Design Features for Users

Screen Design

25. Now that NEWVERN is a more mature software system, the readability of data input screens and reports displayed on the screen should be given a higher priority.

Help Messages

26. Additional help messages should be added to NEWVERN and existing help messages should be improved to provide more specific direction for data entry.

Error Messages

27. Additional error messages should be added to NEWVERN and existing error messages should be improved to provide more specific direction for data entry.

On-Line Documentation

28. On-line documentation in the form of pop-up windows, descriptions of procedures and reports, and specific directions for data entry should be added to NEWVERN to reduce training and support requirements and to increase usability.

Menu Design

29. The NEWVERN menu system should be modified so that selections listed in menus correspond exactly with titles displayed on the selected screens. Modifications to the menu system should improve the conceptual organization and naming of the procedures and reports so that users can locate their choices with greater speed.

Reports

30. Reports should be designed so that they can be viewed on the screen as well as printed.
31. More reports should be developed in two areas: (1) listing of all records in master files and (2) analysis of data for financial and operational management. Report design should be improved to increase readability. Users should be able to customize reports through multiple selection criteria.

Overall User-Friendliness

32. The multitude of minor problems which frustrate the NEWVERN user should be corrected.

135

Technical Design Features and Data Integrity

File Relations

33. All file relations should be more fully documented so that thorough testing and validation of the software can occur. This documentation should include a listing and graphic mapping of all file relations; the index upon which each relation depends; whether the relation is optional or required; and, if required, under what conditions.

Validation

34. Software acceptance testing of NEWVERN should examine the accuracy and completeness of all edit checks (validation) within NEWVERN. These edit checks should reflect A.I.D.'s rules of doing business.
35. The contractor should develop additional programs to test for file relations and data integrity.
36. The contractor should identify data discrepancies in the database and every effort should be made to eliminate this situation. If A.I.D. is conducting business in such a manner as to cause discrepancies in the database, then recommendations for change should be made, in writing to A.I.D., by JSI. If old baseline data are causing these problems, then every effort should be made to handle the issues surrounding these old data and "clean" the database. If NEWVERN permits a total to somehow become incorrect, then the logic of the PROGRESS code should be corrected.
37. If accounting information is contained in the weekly log file created by the database check, then the procedures which create the accounting messages should be placed within the NEWVERN menu system. A.I.D. staff should routinely monitor these accounting messages and exercise oversight.

Processing Speed and Indexing

38. Software acceptance testing of NEWVERN should examine the use of indexes to identify which ones, if any, are not used and can be eliminated and which new indexes can be created to speed processing. This should be a low priority after other testing is completed.

Security

Login and Passwords

39. All login names (whether system names or user names) should be password protected and the responsibility for enforcing this should be given to a system administrator for the CPU (not just NEWVERN). To do this, the system administrator should monitor the /etc/passwd file. Inactive login names should be deleted and users who leave their login unprotected should be locked out of the system and forced to see the system administrator (or manager) to regain access.

NEWVERN Permission System

40. A.I.D. managers should be given permission to read data in NEWVERN's system administration module, which provides error messages and exception reports.

41. NEWVERN should be analyzed to determine if an adequate audit trail exists for financial accounting.

Programming Standards

Naming Conventions for Fields, Variables, Files, and Procedures

42. In order to increase readability and decrease maintenance efforts, standards should be developed for naming fields in NEWVERN, and these standards should be consistent with PROGRESS requirements for finding file relations.
43. The PROGRESS convention of referring to fields within the code with their file name (file-name.fieldname) should be adopted for use throughout the NEWVERN code to increase the readability of the code and reduce maintenance efforts. Standards for naming buffers, workfiles, and variables would also increase the readability of the NEWVERN code.

Block Headers and End Statements

44. A standard of giving names to long blocks of code and documenting the corresponding "end" statement with a simple comment string should be adopted.

Capitalization

45. Capitalization should be considered when developing standards as one way of enhancing readability of the code.

Internal Documentation

46. A standard header for each PROGRESS procedure should be developed. Minimally, the header should include the name of the procedure, summary of the procedure, each modification date, specific nature of the modification, and full name of each person who wrote the procedure or made a modification. Additionally, the header might include, and files opened.

Configuration Management

Hardware Environment

47. A.I.D. staff should be provided with faster connection time to NEWVERN, possibly requiring additional high-speed modems.

Software Environment

Management of Source Code and Object Code

48. JSI should develop configuration management procedures for controlling modifications to NEWVERN and making version releases.

Installation Procedures

49. JSI should develop written technical procedures for making a version release and for installing a NEWVERN database.

System Administration

Account (User) Management

50. The JSI system administrator for the Altos CPU should monitor the /etc/passwd file to ensure that all accounts are password protected.

Backup Procedures

51. A.I.D. should be in physical possession of a copy of the latest version of NEWVERN, including source code.

Archival Procedures

52. Old records in NEWVERN, which reflect work prior to NEWVERN implementation and which cause data discrepancies, should be cleaned up or deleted. It is not recommended at this time that any archival programs be developed.

Quality Assurance

JSI Testing

53. JSI should develop procedures for making code changes and for testing code. These procedures should include careful analysis of all NEWVERN code which might be affected by the code change(s). It should also include detailed documentation. (See section 4.2.2.3 on management of source code and object code and Section 4.1.4.3, on validation, for a full discussion of edit checks and programs to test for data integrity.)

A.I.D. Testing

54. A.I.D. should conduct software acceptance testing of NEWVERN. This testing should be conducted by a senior analyst and PROGRESS programmer. Future software changes and enhancements to NEWVERN should be similarly tested each time a new version is released.

Reporting Procedures for Software Problems

55. A standard format should be developed for recording software trouble reports (STR) and engineering change proposals (ECP).
56. A.I.D., in consultation with JSI, should prioritize the STRs and ECPs and schedule them for completion with a targeted version release date.
57. Each version release should be accompanied with detailed documentation. A.I.D. should conduct testing of each release based on the documentation which describes each change that was made. Corrections should be made by JSI until A.I.D. certifies acceptance (i.e., completion) of all STRs and ECPs included in the release.

Technical Documentation

58. NEWVERN should be fully documented so that it can be supported by others when and if the current developer makes a career change. A completion date should be identified for this documentation and the documentation should be considered a "deliverable" to A.I.D. in the same way that program modifications are.

File Relations

59. File relations should be described both textually and graphically. The graphic illustration should consist of a large wall-sized map of the file structure showing (1) direction of relationship (one-to-many), (2) whether the relationship is always required or optional, and (3) the key field(s) which form the relationships. The textual documentation should describe the same three things as the file structure map, and should also describe the conditions or rules governing each file relation. The file structure documentation should refer to fields by *both* field labels and field names. Referring to the field label, such as "Quantity Received," improves the readability of the documentation. Referring to the corresponding field name in parentheses, such as (shipment.s_amt_r), is required, especially when changes to the code are required.

(For a fuller discussion, see Section 4.1.4 on technical design features and data integrity and Section 4.1.6.1 on naming conventions for fields, variables, files, and procedures.)

Menu Map

60. The NEWVERN menu system should be described both textually and graphically in a wall-sized menu map. Prior to this documentation, the menu design should be improved (see Section 4.1.3.6 on menu design).

PROGRESS Procedures

61. Technical documentation should refer to file and field names *technically*, as well as with their labels. Also, technical documentation should describe step-by-step (i.e., block-by-block) processing within each PROGRESS procedure.¹ This documentation preferably would be internal to the code, but could be provided in the technical reference manual. (See Section 4.1.6.1 on naming conventions for fields, variables, files, and procedures and Section 4.1.6.6 on programming standards for internal documentation.)

Called Procedures and Include Files

62. On-line documentation should be developed to identify all procedures that are called with the PROGRESS "run" statement or used as "include files." A printed listing of this documentation should also be included in the technical documentation for use by analysts.

Directory Structure and Procedures Listing

63. Technical documentation should be developed to describe the UNIX directory system for NEWVERN (including full UNIX pathnames) and listings of all procedures which should be listed under each directory.

Electronic Data Transfer Specifications

64. The technical specifications for electronic data transfers to and from other databases should be included as part of the technical documentation.

¹The term "procedure" is synonymous with "computer program."

Installation and Version Release Procedures

65. Installation procedures and version release procedures should be documented.

Hardware Environment

66. All hardware used by NEWVERN should be identified and networks described in the technical reference manual. Modem phone numbers may be kept separately for security purposes.

Internal Code Documentation

67. More internal code documentation, especially at the block-header level, should be used. (See Section 4.1.6.2 on programming standards for block headers and end statements, Section 4.1.4.1 on structured programming, and Section 4.1.6.6 on internal documentation.)

Software Trouble Reports and Engineering Change Proposals

68. Both JSI and A.I.D. should maintain a notebook containing detailed descriptions of all software trouble reports and engineering change proposals, along with the status of each. (See Section 4.1.2.2 on software trouble reports and engineering change proposals and Appendix B for STR and ECP examples.)

Correspondence between A.I.D. and JSI

69. Both JSI and A.I.D. should maintain a notebook of all correspondence between the two parties regarding FPLM/NEWVERN.

User Documentation

On-Line Documentation

70. More user documentation should be included on-line so that the user can get immediate assistance by reading explanations on the screen without having to refer to written user manuals.

Keyboard Use

71. The use of function keys within NEWVERN should be consistent in all places with the written and on-line documentation.

Menu System

72. A separate section in the user's manual should provide an overview of the NEWVERN Menu System. Each menu should be printed on a separate page. In the top right-hand corner, the menu selection path for finding a submenu should be listed. Additionally, a menu map of NEWVERN should be developed in wall-chart form (see Section 4.4.3 for a description of a menu map).

Reports

73. A table of contents should be included with the user's manual which describes NEWVERN reports so that users can quickly locate the report they want. Report descriptions should

always describe the following three items: record selection criteria, sorting method, and data to be displayed. Reports should also be described on-line.

Lists of Codes and Abbreviations

74. A separate section should be included in the user's manual which provides all necessary codes, abbreviations, and acceptable field entries for NEWVERN data entry.

Overview of Responsibility

75. A separate section should be included in the user's manual which gives an overview of work responsibilities.

Automated Processing versus Data Entry

76. User documentation should be developed to explain steps that the computer performs when triggered by menu selections or data entry performed by the user. This documentation should inform the user of the consequences of his or her action.

Appendix F

PROGRESS Corporation Growth Statistics

PROGRESS Corporation Growth Statistics

SPRING 1992

News Briefs

The latest information on Progress Software Corporation's products, services, people and events

BUSINESS HIGHLIGHTS

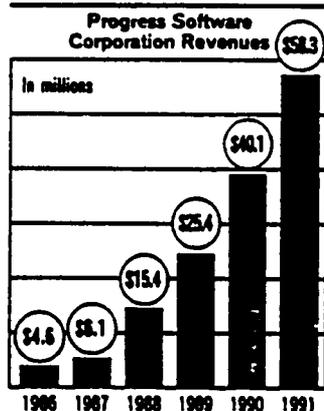
Progress revenues top \$58 million, up 45% from 1990

Progress Software Corporation recently announced its seventh consecutive year of profitable operations. 1991 was highlighted by the company's initial public offering, and saw strong growth in

Progress Software increased sharply to 450, up from 350 in 1990. And in November 1991, Progress Software moved into new, larger headquarters in Bedford, with improved computer and customer training facilities.

According to Progress Software Corporation President Joseph Alsop, "The demand for our software development technology remains strong. In 1991 we introduced products that bring added speed, reliability and ease-of-use to local area networks. PROGRESS NLM Server and PROGRESS for MS-

Windows open new mar-



both revenue and net income. Revenues for the fiscal year ended November 30, 1991 grew 45% to \$58.3 million, when compared to revenues of \$40.1 million recorded in fiscal year 1990. Net income increased 61% to more than \$6 million or \$1.05 per share on 5,816,000 outstanding shares over fiscal 1990 when the company reported income of \$3.7 million or \$.74 per share on 5,132,000 outstanding shares.

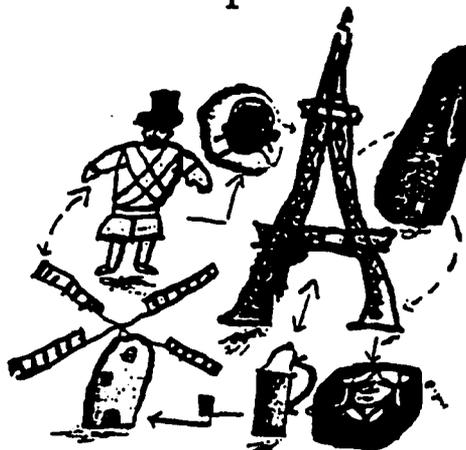
Over the past year, the number of employees at

Progress Software and to the more than 1,000 PROGRESS value-added resellers who can more aggressively pursue business in the PC LAN arena.

"We feel 1992 will be an exciting and challenging year as we introduce PROGRESS for the AS/400, and further extend PROGRESS' capabilities to fully exploit graphical user interfaces, and create and maintain large-scale applications for distributed, multi-vendor environments."

BUSINESS HIGHLIGHTS

New European headquarters



In response to the rapid growth of European business, Progress Software has created a new organization that is chartered with overseeing the efforts of Progress Software's 11 European subsidiaries. Located outside of Rotterdam, Holland, the organization is headed by Ab van Marion, who previously served as regional manager of the Benelux countries.

"With 25 percent of our employees located in Europe, we felt it was time to install a local management team," says Dave Vesty, vice president of international operations. "In addition, we've been running into more and more multi-national deals across Europe. In the past, we've handled these deals by having each country work with the customer's local

office. This new central office will enable us to better service these accounts."

Progress Software's European organization will also respond to the changing face of Europe in 1992 and beyond. According to Vesty, "The organization is working toward leveraging the things we have in common in our subsidiary offices."

The organization will be staffed with Progress sales, marketing, and technical support personnel. For more information, please contact: **Ab van Marion**, Director, European Operations, Progress Software Europe, Kp v.d. Mardelelaan 9, 3062 MB Rotterdam, Netherlands. Tel: 3110 45 31 299 Fax: 3110 45 26 841

MB