

**REVIEW OF INFORMATION SYSTEMS
DEVELOPMENT AND IMPLEMENTATION
METHODOLOGY**

**VIRGINIA DEPARTMENT OF STATE POLICE
DECEMBER 2004**



AUDIT SUMMARY

The Virginia Department of State Police (the Department) has adequate system development guidelines; however, they do not consistently follow them. Staffing shortages, older technologies, reluctance to use commercially available administrative systems, and lack of a clear vision as to where Data Processing should address the business needs of the Department are hampering operations.

Having good policies and procedures is the start of any good process or project undertaking. Not using, following, or enforcing those policies and procedures leads to fragmented development efforts, lack of user acceptance, and systems that become costly to operate.

Although the Department has unique operating needs, many of the core functions are similar to the operations of any other business, agency, or institution. The Commonwealth has available a wealth of systems and knowledge that the Department could use to address these needs without continuing to rely on a system development approach that does not take advantage of these resources.

Management needs to complete a comprehensive strategic plan for operations that considers where the operations should be, rather than what is achievable with only using the existing technology. The Department provides critical services to the Commonwealth and antiquated and inefficient support systems should not hamper their operations.

We recommend that the Department take advantage of the resources within the Virginia Information Technologies Agency (VITA) to re-examine their agency-wide strategic plan. This collaboration should allow the agency to explain its direction, needs, and goals and then allow VITA to work with the Department on a Data Processing's strategic plan that examines the use of current and future technologies. We believe in the area of administrative systems alone, there is the opportunity to meet most needs from existing resources within the Commonwealth with potential lower initial and long-term operating costs.

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Commonwealth of Virginia

Walter J. Kucharski, Auditor

**Auditor of Public Accounts
P.O. Box 1295
Richmond, Virginia 23218**

December 17, 2004

The Honorable Mark R. Warner
Governor of Virginia
State Capital
Richmond VA

The Honorable Lacey E. Putney
Chairman, Joint Legislative Audit
and Review Commission
General Assembly Building
Richmond, VA

We have completed a review of Information System Development and Implementation Methodology used by the Virginia Department of State Police (the Department). As result, we have prepared a report **“Review of Information Systems Development and Implementation Methodology at the Virginia Department of State Police.”**

Objectives

We had three objectives for our review of the Department’s information systems development and implementation methodology:

1. Determine if the Department’s short and long-term data processing strategic plan adequately addresses alternatives to the development of new systems and changes to existing systems to support the operational reliance on those systems;
2. Determine if the Department’s development and implementation guidelines comply with the State standards; and
3. Determine if the Department follows its development and implementation guidelines when upgrading, enhancing, or implementing information systems.

Scope

In conducting this review, we researched the Department’s information system infrastructure, including the platforms, applications, and policies. We obtained this information through interviews with agency personnel, reviews of policies and procedures, and reviews of system documentation. We documented the status of the systems and identified several issues with the systems as they currently operate. This report includes the status of the following system development projects:

1. Conversion of the Unisys IX 4400 mainframe Mapper programs and the 1100 Series Data Management System (DMS 1100) databases;
2. Materials Management System; and
3. Consolidated Billing System.

Summary

The Department has sound system development guidelines; however, they do not appear to be following them. Staffing shortages, dated technologies, reluctance to use commercially available systems, and lack of a clear vision as to where Data Processing should address the business needs of the Department are hampering operations.

Having good policies and procedures is the start of any good process or project undertaking. Not using, following, or enforcing those policies and procedures leads to fragmented development efforts, lack of user acceptance, and systems that become costly to operate.

We recommend that the Department take advantage of the resources within the Virginia Information Technologies Agency (VITA) to re-examine their agency-wide strategic plan. This collaboration should allow the agency to explain its direction, needs, and goals and then allow VITA to work with the Department on a data processing strategic plan that examines the use of current and future technologies. We believe in the area of administrative systems alone, there is the opportunity to meet most needs from existing resources within the Commonwealth with potential lower initial and long-term operating costs.

We discussed this report with agency management on January 4, 2005.

AUDITOR OF PUBLIC ACCOUNTS

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OVERVIEW

The Virginia Department of State Police (the Department) operates multiple, critical systems that support local, state, and national law enforcement activities in the Commonwealth. These mission critical systems operate 24 hours a day, seven days a week. The Department is also a central gateway to national systems such as the Federal Bureau of Investigation's National Criminal Information Center (NCIC) and the National Sex Offender Registry. It would be a significant public safety issue if any of these systems failed for any length of time.

The Department operates over 50 systems and/or applications including many criminal systems, including the Computerized Criminal History System (CCH), and various firearm databases. The CCH and other databases are critical components of the Virginia Criminal Information Network (VCIN). Supporting these systems are administrative applications for internal and external tracking systems and criminal, fingerprint, and weapon databases.

Additionally, the Department operates numerous administrative systems, which support the operations of the officers in the field as well as the overall management of the Department. These systems include the accounting and reporting, human resource management, overtime payroll, materials management, and the executive information systems.

The Department has had a number of on-going projects that we have been monitoring for the last several years. Our last report issued in April 2003 addressed the progress of these and other projects at the time. This report represents a follow up to our past report and provides a current status on three projects.

The report includes the status of the following projects:

1. Conversion of the Unisys IX 4400 mainframe Mapper programs or 1100 Series Data Management System (DMS 1100) databases;
2. Materials Management System; and
3. Consolidated Billing System.

We reviewed the status of these projects by using the Department's guidelines for data processing projects and systems development. We believe that these guidelines meet the basic requirements set for Commonwealth agencies and institutions and represent best practices. In all cases, we measured the Department's performance on the projects and system against their internal guidelines.

Strategic Planning

Fundamental to an organization with complex systems and operational reliance on those systems is having a short- and a long-term strategic plan for data processing. These plans place into perspective the direction of data processing within the organization and the priorities that organization places on this function.

Recognizing the need for sound strategic planning in the Commonwealth of Virginia, the Virginia Information Technologies Agency (VITA) and its predecessor agencies have developed guidelines for the development, preparation, and participation of management and others in the planning process. These guidelines set out considerations, ideas, and approaches an agency can take in developing a strategic plan.

The guidelines recognize that agencies need to develop realistic strategic plans; however, they do not place restrictions on what approaches or constraints an agency may wish to consider. The guidance suggests that agencies do their planning with the most flexibility possible.

These strategic plans must not only address the need for improving or developing systems, but also address the need to keep systems, hardware, and operational costs in line and current with new technologies. Further, the plans should consider the array of options available for meeting an agency's needs. Plans that do not consider alternative technologies, purchasing options, and most importantly operational changes greatly limit, if not totally restrict, the ability of the plan to provide cost effective alternatives to the agency.

While strategic planning should address the realities of funding and other constraints, it should also recognize that not addressing changing technologies has significant costs which may far outweigh the initial short-term savings. Also, not recognizing and anticipating new technologies can result in short-term solutions and cost savings that in practice only defer and increase long-term costs.

The Department's strategic plan complied with the guidelines established by VITA, including having management approval. However, our review of the plan found that the current and previous plans do not effectively address new technologies or alternatives to the development of new systems and modifications to existing systems. This type of strategic planning, as discussed later in this report, has and will continue to have long-term consequences for the Department.

System Development Life Cycle

The Commonwealth's information systems development and maintenance guidelines state that the ultimate responsibility for the management, control, development, maintenance, enhancement, and use of information systems rests with the individual agency. Accordingly, all state agencies must adopt written guidelines for the development, maintenance, and enhancement of information systems. The purpose of these written guidelines is to ensure quality, effective, and maintainable information systems

The System Development Life Cycle (SDLC) guidelines represent the best practices for the effective operation of systems. The standards reflect extensive research of both private industry and governmental practices and represent the guidelines for the development, implementation, operation, and ultimately the replacement of a system. These guidelines deal not only with technical matters, but incorporate the best practices of considering user needs and operating processes.

The SDLC process provides that the design and implementation of an application or system occurs in a methodical, logical, and systematic approach. This type of approach is important to ensure that new computer systems will meet user requirements. Without a methodology it is difficult to track system budgets, time lines, and deliverables.

The Department has an SDLC approach as evidenced in Section IV, of the Virginia State Police Data Processing Policies and Procedures Manual item E, titled *Services*. This section, revised September 2003, dictates the development and major modification of information systems and reads as follows.

The development of new computer application systems or the major modification of current application systems must be accomplished as a joint effort between the requester and Data Processing. It is critical to the success of the system that the end user be fully involved in the development or major modification of the system. The amount of involvement by the end user determines the degree of success of the system to meet the user's needs.

In order to ensure the system is developed or modified with adequate participation by the end user, the following procedures must be followed:

1. The requester must designate a primary contact who will work closely with the systems analyst assigned by the Data Processing Division during all phases of the development or major modification of the system.
2. Depending on the magnitude of the effort, it may be required that the primary user be released from day-to-day responsibilities in order to participate in the development or modification.
3. In addition to the primary user contact, other persons in the requesting organization affected by the system should be involved in the process. They should also be involved in the acceptance process for components of the system, such as screen layouts, report layouts, and new processing procedures as they affect their area of responsibility.
4. In most cases, application systems will be developed or undergo major modifications using the standard seven phase methodology: (1) Project Initiation; (2) Requirements Definition; (3) General Design; (4) Detail Design; (5) Development; (6) Implementation; (7) Evaluation. This phased approach is employed primarily to provide feedback to decision makers at the completion of each phase for deciding how to proceed to the next phase. It is the responsibility of the end user to thoroughly evaluate the documentation produced by the Requirements Definition Phase and the General Design Phase, ensuring that the system being developed or modified is meeting objectives. For mutual acceptance of the developing or modified system, it is required that there be a written sign-off by the Division Commander for the requesting organization at the completion of Phase 2 (Requirements Definition), Phase 3 (General Design), and Phase 6 (Implementation).

All projects, whether maintenance or new systems, conform to the above systems development life cycle. The formality of the cycle will vary according to the complexity of the system under development.

The Department's system development guidelines are adequate as written and meet all the expectations set by the Commonwealth's anticipated SDLC. As stated earlier, the purpose of our review was to determine if Department personnel followed the guidelines, and if not, whether their approach hindered the project.

In addition to these guidelines it is important that Data Processing utilize standard project management techniques. These include documentation that includes the tasks, activities, deliverables, and milestones to each development phase. The project plan should identify the estimated resources and time required to complete the project.

Good project management requires active monitoring of a project's progress against the plan and revision of the plan as necessary. In addition there should be continuous monitoring of data processing staff performance and progress meetings that include data processing staff, users, and other stakeholders.

System Conversion

Until August 2004, the majority of the Department's data applications resided on a Unisys IX 4400 mainframe using Unisys' Mapper programs or 1100 series data management system (DMS 1100) databases. As with most mainframe users, the Department faced the standard legacy system suite of problems. The applications have grown over many years to provide a core functionality that was deeply engrained in the organization and its business processes. However, most of these applications are inflexible, many have batch-oriented processes, and documentation for system modifications or development is inadequate. These issues make the systems environment difficult to adapt to meet the Department's changing needs.

The Department's lease for the system software expired on November 30, 2003. The vendor had replaced this platform with a newer product because the hardware associated with this operating system was out of date, and the number of users had declined making support unprofitable to the vendor. The current product would become unsupported within the next few years. The continued use of this software and hardware would require the Department to eventually seek support from a secondary vendor. Upon expiration of the current contract the Department could either enter into another 5-year lease for this dated equipment or replace the platform. Rather than enter into a 5-year contract, the Department opted to pay a significantly higher monthly support fee and seek an alternative platform.

The Department obtained funding and approval to replace the Unisys system. This approval included a new platform; however, the current application programming languages would remain. The process only converted the existing programs to a new platform. These programs remain in the older language and will eventually require conversion to modern languages.

Due to the potential limited availability of funding, the project was completed in a short time frame, and, the Department did not follow many of their internal project management guidelines. Staff developed a task schedule to transfer and convert the information to the new operating system and platform as quickly as possible.

While the conversion from the Unisys 4400 mainframe to the Sun 6800 UNIX server was successful, it lacked a comprehensive project budget and a formal development plan. This has made the project difficult to track and created problems for the users, since many of them were unsure if their system would operate properly in this new environment.

In addition, the conversion moved the programs in their current language to the new platform. The new system has better response time; however, the historical problems related to the original programs such as a lack of documentation still exist. The recent conversion should be an interim solution as the problems with the programs and data included in the databases still exist; however, there are no formal long-range plans or funding to complete the conversion to a current programming language.

In order to migrate the DMS 1100 programs from the Mainframe to the UNIX Server, the Department sole-sourced a contract with Inglenet Business Solutions. The vendor's migration methodology is a three-

phase process; data modernization; user interface modernization; and program code modernization. The Department only focused on the first phase, data modernization, which allowed for a quick conversion to a new platform. During this phase, the contractor placed the data into a newly designed data model using a modern relational database management system. However, the basic components of the legacy system continue to rely on the mainframe programs.

Most of the Department's administrative systems and many of the tracking applications also remain in the mainframe program language Mapper. Using a conversion technique, the staff simply transferred these applications over to the new platform using the same programming language. Therefore, the numerous systems change requests, antiquated user interfaces, and lack of ad hoc reporting still remains.

Additional problems with this conversion also remain, including the age of the systems, and the use of dated programming languages and database management systems continues to make it difficult for users to extract information. Further, finding experienced staff with the necessary knowledge to maintain the dated systems in this environment has become increasingly difficult. The Department cannot recruit, train, and retain enough employees to do this work and must rely on contractors.

Observations

All software and hardware products have a useful life, which vendors measure in both users and cost of maintaining products to work with commonly used technologies. As the hardware technology evolves, most users tend to upgrade their operations to keep pace with these changes. However, as in most markets, when the use of technology changes and number of users of a particular product declines, the vendor stops supporting that product. This evolution occurs neither quickly nor without the knowledge of an informed user.

We do not fault the Department for taking the actions they did. It was essential that they maintain and keep the systems operational in order to meet their mission. We do, however, believe that having to take these actions reveals a more fundamental problem with both the strategic planning for information technology and compliance with their system development life cycle.

Management still faces two problems arising from the conversion. The first problem is the ability to recruit, train, and retain staff to keep these systems operational. These systems and their software require a specialized knowledge that is not commonly available in the market place. This problem drives up the operating costs since the Department cannot draw on a wider pool of either candidates or contractors. Investing time, money, and training costs in personnel with these skills also makes transitioning to other technologies more difficult and expensive.

The second problem arises from the conversion from the mainframe. This conversion should represent the first step toward a long-term solution. The current conversion provided a quick, short-term solution that resolved only immediate issues. The typical goal of this type of modernization project is to create a new IT environment that employs current technology in the areas of database, user interface, and development techniques. The approach to accomplishing this goal is to segregate the entire process into discrete phases where each phase has a specific deliverable with measurable results and benefits. However, the Department has no formal project plan to accomplish these phases and has not established deliverables.

Management needs to recognize that it cannot reduce long-term operating costs until there is a complete modernization of the systems. This includes incorporating current technology with advancements to design an approach that allows systems to adapt with future changes in technology. Many businesses and governments are addressing these issues by adopting an approach that tends to not require customized software or unique operating platforms.

Conclusion

While the conversion provided a quick, short-term fix and avoided significant operating costs, it does not begin to address the Department's long-term needs and approaches in data processing. Additionally, the conversion did not follow or document the information required by the Department's guidelines for major data processing projects. The project development and implementation did not adequately involve the users. Implementation was completed prior to resolving what users considered "critical problems" and adequate training.

The current data processing strategic plan does not address how and when the conversion completion will occur. If the Department does not ensure completion of all conversion phases to move their systems from the outdated programming language to a current technology, they will find, at some point, the personnel costs will exceed reasonable costs and the existing technology will be as dated as the technology it replaced.

Materiels Management System

The scope of the Materiels Management System (MMS) project, initiated in 2001, was to enhance the older inventory system and modernize the user interface. The older inventory system was not meeting user needs. Over time, users had submitted numerous system change requests and Data Processing decided to incorporate these changes in the systems enhancement project. MMS was developed in-house as a Mapper application and it currently serves as the Department's primary inventory system. The purpose of MMS is to provide an automated process for controlling and monitoring the purchasing, warehousing, issuance, distribution, and inventory of equipment and supplies.

We compared the MMS system development against the internal systems development guidelines to determine how a project following these guidelines could have resulted in the numerous problems warehouse personnel has reported with MMS. We did confirm that many of the balances, reports, and other data are in error because Data Processing did not comply with their own SDLC development guidelines, especially those identifying the involvement of users at each phase of development.

Although the guidelines extensively discuss the involvement of the users, we found that users did not have an active involvement in the development and acceptance process for components of the system, such as screen layouts, report definitions, and new processing procedures as they affect their area of responsibility.

The lack of user involvement has continued into the post implementation phase and contributed to some of the on-going operational problems.

- Data Processing personnel do not respond timely to system change requests and often do not fix the original problem.
- There is little or no communication between the Warehouse and Data Processing. When a problem occurs with the inventory system, it is hard to reach anyone in Data Processing.
- Data Processing is slow in responding to warehouse requests; this is a critical issue during inventory periods.
- Many users have created manual inventory records for high-risk inventory items such as weapons and badges to compensate for the system errors.

Observations

The degree of user involvement is critical to a system's success. The MMS system is an example of where the lack of involvement creates problems and causes them to continue into the post operational phase. Several other factors contribute to these problems. High on the list is the lack of personnel and shifting priorities such as the conversion of the operating system and hardware. While both of these factors explain why management does not have sufficient resources to fix the system, they also tend to hide a fundamental issue at the start of the process.

Well-defined user requirements are critical to the success of any system development project. However, such requirements have been very difficult to do correctly because data processing developers and business area users have a different understanding of the business. The problems with MMS emphasize the importance of developing a system using a functional approach. The developers did not completely understand the inventory processes and the warehouse staff were not involved in the development of the system to identify the problems during development.

We can find no evidence that the Department conducted a cost benefit or "create versus buy" analysis before undertaking the development of MMS. It also appears that there was a commitment to only use existing technologies and not consider other alternatives.

MMS does not perform any function or have any special reporting features that several commercially available programs do not perform. While some of these packages would have required the Department to change some of its practices, most of these changes are accepted best practices in materials management for both industry and government.

Conclusion

If the Department had followed their system development guidelines, involved the users by considering their requirements, and looked at commercially available options, we believe the system would operate more effectively. We further believe that a commercially available product would have lowered the overall cost of operations and implementation. This is still a cost consideration as the Department must determine whether to continue operating this system with its existing technology through correcting and reprogramming the current system.

Consolidated Billing System

The Department collects approximately \$10 million in annual revenues from several sources. These sources include fees for criminal history checks and payments by contractors and others for Department time spent monitoring construction zones and providing airport security. There is a billing mechanism for criminal history fees; however, the accounting system uses several manual or user developed computer tools, such as Microsoft Excel spreadsheets, to bill and track other revenue sources. None of the other billing and tracking systems provides audit trails or security features.

Beginning in July 1998, the Department's Property and Finance Division has continually requested a consolidated billing system for all revenue sources. The fees and other billings include a 10 percent administrative fee that could fund the project. Without Data Processing's input, the Property and Finance Division independently developed a requirements definition document for a billing system. Data Processing management determined the requirements document did not correspond with their information technology strategic plan and did not start any development efforts. The Department's management later agreed that a

consolidated billing system is a priority; however, none of the parties developed any formal plans, budget, or document reconciling the requirements document with the information technology strategic plan.

The Department operates a number of systems that would need to transfer information to the billing system, or the Department would have to re-enter information into the billing system. Primary data would come from a time and attendance system and several other sources. Trying to determine how to transfer this information was the initial reason for Data Processing's delay in developing this system. Additional delays occurred when the Data Processing needed to convert its software, hardware, and other operating process as discussed earlier.

Recently, Data Processing announced that the system development effort should result in having a system prototype available in January 2005. However, none of the users were involved in designing, reviewing or determining if the system will meet their needs.

Observations

Except for the initial requirements definitions document none of the users of the new system have been involved in the development of the billing system. This approach is in direct conflict with the Department's system development guidelines. It is important that a system is developed or modified with adequate participation by the end user, or system user acceptance is questionable.

As with MMS, there was no examination of commercially available packages. Data Processing based its decision to develop this system in-house on trying to avoid duplicate data entry; however, continuing with the current technology will cause future maintenance and upgrade issues.

Conclusion

Like MMS, numerous commercially available packages exist that would meet the needs of the user and reduce long-term maintenance and operating costs. Further, even if the system operates, by not following internal system development guidelines, this system will encounter significant user resistance to adoption. Additionally, if Data Processing is having problems maintaining and addressing issues in operating MMS, there appears to be serious questions about their ability to implement and make this system effectively work.

OVERALL OBSERVATIONS

The Department has sound system development guidelines; however, they do not appear to be following them. Staffing shortages, dated technologies, reluctance to use commercially available systems, and lack of a clear vision as to where Data Processing should address the business needs of the Department are hampering operations.

Management needs to complete a comprehensive strategic plan for operations that considers where the operations should be, rather than what is achievable with only using the existing technology. The Department provides critical services to the Commonwealth and antiquated and inefficient administrative support systems should not hamper their operations.

Although, the Department has unique operating needs, many of the core functions are similar to the operations of any other businesses, agencies, or institutions. The Commonwealth has available a wealth of

systems and knowledge that the Department could use to address these needs without continuing to rely on a system development approach that does not take advantage of these resources.

Having good policies and procedures is the start of any good process or project undertaking. Not using, following, or enforcing those policies and procedures leads to fragmented development efforts, lack of user acceptance, and having systems that in the long run become costly to operate.

OVERALL CONCLUSION

We recommend that the Department take advantage of the resources within the Virginia Information Technologies Agency (VITA) to re-examine their agency-wide strategic plan. This collaboration should allow the agency to explain its direction, needs, and goals and then allow VITA to work with the Department on a data processing strategic plan that examines the use of current and future technologies. We believe in the area of administrative systems alone, there is the opportunity to meet most needs from existing resources within the Commonwealth with potential lower initial and long-term operating costs.

Additionally, the Department should use VITA's knowledge base to review and suggest staffing levels and assist in developing a plan to recruit, train, and retain personnel. While outside of VITA's normal duties, the critical nature of this operation should warrant this assistance.

Within Data Processing, management needs to make sure that all major projects and systems follow and use their internal guidelines. Management may need to consider some project management training for both the data processing staff and key users.



COMMONWEALTH of VIRGINIA

Colonel W. S. (Steve) Flaherty
Superintendent

DEPARTMENT OF STATE POLICE
P. O. Box 27472, Richmond, VA 23261-7472
(804) 674-2000

Lt. Colonel John B. Scott
Deputy Superintendent

January 10, 2005

The Honorable Walter J. Kurcharski
Auditor of Public Accounts
PO Box 1295
Richmond, VA 23218-1295

Dear Mr. Kurcharski:

We have completed a review of your report, "Information Development and Implementation Methodology used by the Virginia Department of State Police." While we do not agree with some of the conclusions reached in this report, we acknowledge the need to improve our performance in some areas of Information Technology development and implementation.

We look forward to working with your staff to improve in this area in the future.

Sincerely,

A handwritten signature in dark ink, appearing to read "W. S. Flaherty", with a long, sweeping horizontal line extending to the right.

Superintendent

WSF/DBCjr:bdc