

GAO

United States General Accounting Office

Report to the Chairman, Subcommittee
on Compensation, Pension, Insurance
and Memorial Affairs, Committee on
Veterans Affairs, House of
Representatives

June 1996

SOFTWARE CAPABILITY EVALUATION

VA's Software Development Process Is Immature



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United States
General Accounting Office
Washington, D.C. 20548

Accounting and Information
Management Division

B-261652

June 19, 1996

The Honorable Terry Everett
Chairman, Subcommittee on Compensation,
Pension, Insurance and Memorial Affairs
Committee on Veterans Affairs
House of Representatives

Dear Mr. Chairman:

You requested that we review the Department of Veterans Affairs' (VA) capability for developing and maintaining software for its computer-based systems. The Department depends on these systems to support program operations and assist in managing the achievement of critical mission objectives. Our objective was to review software development processes at the Veterans Benefits Administration (VBA) and VA's Office of Information Resources Management's Austin Automation Center (AAC). The sites and projects were selected by VBA and VA, respectively, as those that represent their best software development processes and practices.

Background

VBA is in the process of modernizing many of its older, inefficient systems and has reportedly spent an estimated \$294 million on these activities between October 1, 1986 and February 29, 1996. The modernization program can have a major impact on the efficiency and accuracy with which over \$20 billion in benefits and other services is paid to our nation's veterans and their dependents. However, in the last 6 years some aspects of VBA's service to the veterans have not improved. For example, in the past 6 years, VBA's reported processing time for an original compensation claim rose from 151 days in fiscal year 1990 to 212 days in fiscal year 1994. In March 1996 the average time was 156 days.

Software development is a critical component of this major modernization initiative. VBA, with the assistance of contractors, will be developing software for the Veterans Services Network (VETSNET) initiative, a replacement for the existing Benefit Delivery Network. For efforts like VETSNET to succeed, it is crucial that VBA have in place a disciplined set of software development processes to produce high quality software within budget and on schedule.

VBA relies upon its own staff and contractors to develop and maintain software that is crucial to its overall operations. In fiscal year 1995, VBA

had 314 full-time equivalents, with payroll expenses of \$20.8 million, devoted to developing and maintaining software throughout the organization. It also spent \$17.7 million in contract services in these areas.

Scope and Methodology

To evaluate VA's software development capability, version 2.0 of the Software Engineering Institute's (SEI)¹ software capability evaluation (SCE) method² was used by an SEI-trained team of GAO specialists. The SCE is a method for evaluating agencies' and contractors' software development processes against SEI's five-level software Capability Maturity Model (CMM), as shown in table 1. These levels and the key process areas (KPAs) described within each level define an organization's ability to develop software, and can be used to improve its software development processes. The findings generated from an SCE identify (1) process strengths that mitigate risks, (2) process weaknesses that increase risks, and (3) improvement activities that indicate potential mitigation of risks.

¹SEI is a nationally recognized, federally funded research and development center established at Carnegie Mellon University in Pittsburgh, Pennsylvania, to address software development issues. In the late 1980's, the Software Engineering Institute, with assistance from the Mitre Corporation, developed a process maturity framework that would help organizations improve their software process. In general, software process maturity serves as an indicator of the likely range of cost, schedule, and quality results to be achieved by projects within a software organization.

²Version 2.0 of the SCE method is based on SEI's Capability Maturity Model, Version 1.1.

Table 1: CMM Levels and Descriptions³

Level	Name	Description
5	Optimizing	Continuous process improvement is enabled by quantitative feedback from the process and from piloting innovative ideas and technologies.
4	Managed	Detailed measures of the software process and product quality are collected. Both the software process and products are quantitatively understood and controlled.
3	Defined	The software process for both management and engineering activities is documented, standardized, and integrated into a standard software process for the organization. All projects use an approved, tailored version of the organization's standard software process for developing and maintaining software.
2	Repeatable	Basic project management processes are established to track cost, schedule, and functionality. The necessary process discipline is in place to repeat earlier successes on projects with similar applications.
1	Initial	The software process is characterized as ad hoc, and occasionally even chaotic. Few processes are defined, and success depends on individual effort.

Source: Capability Maturity Model for Software, Version 1.1, (Technical Report CMU/SEI-93-TR-24, February 1993).

We requested that VA identify for our evaluation those projects using the best software development processes implemented within VBA and AAC. VBA and AAC identified the following sites and projects.

- VBA
 - Hines, IL

—Compensation & Pension/Financial Management System

—Claims Processing System

³ According to an SEI study (i.e., Moving on Up: Data and Experience Doing CMM-Based Process Improvement, Technical Report CMU/SEI-95-TR-008, August 1995) of 48 organizations that implemented software process improvement programs, the time required to increase process maturity from level 1 to level 2 took an average of 30 months, with a range of 11 months to 58 months.

—Rating Board Automation

- Philadelphia, PA

—Variable Loan Rate

- Washington, DC

—Veterans Services Network

- AAC
- Austin, TX

—On-Line Data Entry

—Personnel Accounting Integrated Data

We evaluated the software development processes used on these projects, focusing on KPAS necessary to achieve a repeatable capability. Organizations that have a repeatable software development process have been able to significantly improve their productivity and return on investment. In contrast, organizations that have not developed the process discipline necessary to better manage and control their projects at the repeatable level incur greater risk of schedule delay, cost overruns, and poor quality software.⁴ These organizations rely solely upon the variable capabilities of individuals, rather than on institutionalized processes considered basic to software development.

According to SEI,⁵ processes for a repeatable capability (i.e., CMM level 2) are considered the most basic in establishing discipline and control in software development and are crucial steps for any project to mitigate risks associated with cost, schedule, and quality. As shown in table 2, these processes include (1) requirements management, (2) software project planning, (3) software project tracking and oversight, (4) software subcontract management, (5) software quality assurance, and (6) software configuration management.

⁴Capability Maturity Model for Software, Version 1.1 (Technical Report CMU/SEI-93-TR-24, February 1993).

⁵Software Capability Evaluation, Version 2.0, Method Description (CMU/SEI-94-TR-06, June 1994).

**Table 2: CMM Level 2 “Repeatable”
Key Process Area Descriptions**

CMM Level 2 KPAs	Description
Requirements management	Defining, validating, and prioritizing requirements, such as functions, performance, and delivery dates.
Project planning	Developing estimates for the work to be performed, establishing the necessary commitments, and defining the plan to perform the work.
Project tracking and oversight	Tracking and reviewing software accomplishments and results against documented estimates, commitments, and plans and adjusting these based on the actual accomplishments and results.
Software subcontract management	Selecting qualified contractors and managing them effectively.
Software quality assurance	Reviewing and auditing the software products and activities to ensure that they comply with the applicable processes, standards, and procedures and providing the staff and managers with the results of their reviews and audits.
Software configuration management	Selecting project baseline items, such as specifications; systematically controlling these items and changes to them; and recording and reporting status and change activity for these items.

We conducted our review between August 1995 and February 1996, in accordance with generally accepted government auditing standards.

Results in Brief

VA does not satisfy the criteria for a level 2 (i.e., repeatable) software development capability on any of the seven projects they identified as using their most mature processes. None of the projects reviewed satisfy any of the criteria (i.e., KPAs) that the Software Engineering Institute’s CMM requires for a repeatable process. For example, VBA is extremely weak in the requirements management, software project planning, and software subcontract management KPAs with no identifiable strengths or improvement activities. As a level 1 organization, VBA cannot reliably develop and maintain high-quality software on any major project within existing cost and schedule constraints, placing the VBA modernization program at risk.

Similarly, AAC has a level 1 software development capability. It does not satisfy any of the criteria (i.e., KPAs) for a level 2 (i.e., repeatable) process.

Austin's weakest KPA is software subcontract management with no identifiable strengths or improvement activities.

However, there are some strengths and improvement activities that both VBA and AAC can build upon to improve their respective software development processes. For example, VBA can build upon its strengths in the software quality assurance KPA, and its improvement activities in the software configuration management KPA. Similarly, AAC can build upon its strengths in the software quality assurance and software configuration management KPAs. Activities of this nature will help both VBA and AAC move toward a level 2 (i.e., repeatable) software development capability.

Veterans Benefits Administration Software Practices

Highlights of our evaluation of VBA's software practices using the SEI criteria outlined in appendix II follow.

- Requirements Management - The purpose of requirements management is to establish a common understanding between the customer and the software project of the customer's requirements that will be addressed by the software project. The first goal within this KPA states that, "system requirements allocated to software are controlled to establish a baseline for software engineering and management use." VBA does not manage and control system requirements as required by this goal. Moreover, members of software-related groups are not trained in requirements management activities. Also, changes made to software plans, work products, and activities resulting from changes to the software requirements are not assessed for risk.
- Software Project Planning - The purpose of software project planning is to establish reasonable plans for performing the software engineering and for managing the software project. VBA projects do not have software development plans, estimates for software project costs are not derived using conventional industry methods and tools, and VBA is unable to show the derivation of the estimates for the size (or changes to the size) of the software work products. Also, individuals involved in the software project planning are not trained in estimating and planning procedures applicable to their area of responsibility.
- Software Project Tracking and Oversight - The purpose of software project tracking and oversight is to provide adequate visibility into actual progress so that management can take effective actions when the software project's performance deviates significantly from software plans. VBA does track software project schedules against major milestones; however, as mentioned previously, these schedules and milestones are not derived

using conventional industry methods nor is there a comprehensive software plan against which to track activities. Moreover, the size of software work products (or the size of changes to software work products) are not tracked, and the software risks associated with cost, resource, schedule, and technical aspects of the project are not tracked.

- Software Subcontract Management - The purpose of software subcontract management is to select qualified software subcontractors and manage them effectively. VBA does not have a written organizational policy that describes the process for managing software contracts. Additionally, the software work to be contracted is neither defined nor planned according to a documented procedure. Finally, software managers and other individuals who are involved in developing, negotiating, and managing a software contract are not trained to perform these activities.
- Software Quality Assurance - The purpose of software quality assurance is to provide management with appropriate visibility into the process being used by the software project and of the products being built. VBA has a software quality and control (SQ&C) group that has a reporting channel to senior management, independent of the project managers. The SQ&C group also performs testing of the software code. However, the SQ&C group does not participate in other software quality assurance (SQA) functions, such as the preparation, review, and audit of projects' software development plans, standards, procedures, and other work products. Also, projects do not have SQA plans.
- Software Configuration Management - The purpose of software configuration management is to establish and maintain the integrity of products of the software project throughout the project's software life cycle. VBA has provided formal training to its staff in defining software processes. However, VBA cannot effectively control the integrity of its software work products because it has no software configuration control board, it does not identify software work products to be placed under configuration management, and it has no configuration management library system to serve as a repository for software work products. VBA has begun improvement activities in this area by (1) establishing a software configuration management group and (2) drafting a software configuration management procedure.

Following a presentation of GAO's SCE results to the Chief Information Officer of VBA, the Director of VBA's Office of Information Systems forwarded a letter to GAO citing a number of initiatives that are currently underway to address some of the stated deficiencies. Initiatives cited by the VBA include:

- development and distribution of interim configuration management procedures;
- identification of a library structure to hold all of the work products from the development process; and
- initiation of several meetings with SEI to discuss the Software CMM.

Austin Automation Center Software Practices

Similar to VBA, we compared the CMM criteria in appendix II to the software development practices at AAC. Summary results of this evaluation follow.

- Requirements Management - AAC does not create or control a requirements baseline for software engineering. Also, AAC does not manage or control requirements. AAC does have a process for negotiating periodic contractual arrangements with customers, but this process does not include baselining and controlling software requirements.
- Software Project Planning - Although AAC documents its schedule estimates for software development projects, there is (1) no defined methodology in use for estimating software costs, size, or schedule, (2) no derivation of estimates for the size (or changes to the size) of software products, and (3) no derivation of the estimates for software project costs. Similarly, AAC uses a project planning tool called "MultiTrak". However, projects do not have software development plans.
- Software Project Tracking and Oversight - AAC performs schedule tracking at major milestones. However, the goals for this KPA call for (1) the tracking of actual results and performances against software plans, (2) the management of corrective actions when deviations from the software plan occur, and (3) the affected parties to mutually agree to changes in commitments. AAC does not conform to these goals. For example, AAC does not track (1) the software risks associated with cost, resource, schedule, and technical aspects of the project and (2) the size of software work products (or size of changes to software work products).
- Software Subcontract Management - Although the goals for this KPA emphasize the selection of qualified software subcontractors and managing them effectively, AAC does not (1) have a documented procedure that explains how the work to be contracted should be defined and planned and (2) ensure that software managers and other individuals who are involved in establishing a software contract are trained to perform this activity.
- Software Quality Assurance - The goals within this KPA emphasize (1) the verification of the adherence of software products and activities to applicable standards, procedures, and requirements and (2) the reporting of noncompliance issues that cannot be resolved within the project to

senior management. AAC has an automated data processing system integrity guideline and a systems integration service (SIS) group that has a reporting channel to senior management and is independent of the project managers. However, projects do not have SQA plans; the SIS group does not participate in certain SQA functions, such as the preparation, review, and audit of projects' software development plans, standards, and procedures; and members of the SIS group are not trained to perform their SQA activities.

- **Software Configuration Management** - AAC performs software (i.e., code only) change control using a tool called "ENDEVOR," and its employees are trained in the use of this tool. However, the scope of the goals within this KPA cover all products in the entire software life cycle and not just the software code. AAC has not identified software work products (with the exception of software code) that need to be placed under configuration management, established a configuration management library system that can be used as a repository for software work products, or established a software configuration control board.

Unless both VBA and AAC initiate improvement activities within the various KPAs and accelerate those already underway, they are unlikely to produce and maintain high-quality software on time and within budget.

Conclusions and Recommendations

Because VBA and AAC do not satisfy any of the KPAs required for a level 2 (i.e., repeatable) capability, there is no assurance that (1) investments made in new software development will achieve their operational improvement objectives or (2) software will be delivered consistent with cost and schedule estimates. To better position VBA and AAC to develop and maintain their software successfully and to protect their software investments, we recommend that the Secretary of Veterans Affairs take the following actions:

- Delay any major investment in software development beyond that which is needed to sustain critical day-to-day operations until the repeatable level of process maturity is attained.
- Obtain expert advice to assist VBA and AAC in improving their ability to develop high-quality software, consistent with criteria promulgated by SEI.
- Develop an action plan, within 6 months from the date of this letter, that describes a strategy to reach the repeatable level of process maturity.
- Implement the action plan expeditiously.
- Ensure that any future contracts for software development require the contractor have a software development capability of at least CMM level 2.

Agency Comments and Our Evaluation

VBA comments responded to its SCE results, and VA comments responded to the SCE results for AAC.

VBA Comments on GAO Recommendations

In commenting on a draft of this report, the Veterans Benefits Administration (VBA) agreed with four of our recommendations and disagreed with one recommendation. VBA stated that while it agreed that a repeatable (i.e., level 2) level of process maturity is a goal that must be attained, it disagreed that "...all software development beyond that which is day-to-day critical must be curtailed..." VBA further stated that the payment system replacement projects, the migration of legacy systems, and other activities to address the change of century must continue. While we agree that the software conversion or development activities required to address issues such as the change of century or changes to legislation must continue, we would characterize these as sustaining critical day-to-day operations. However, major system development initiatives in support of major projects such as the system modernization effort, which involves several system replacement projects and the migration of legacy systems, and VETSNET, which includes several payment system replacement projects, should be reassessed for risk of potential schedule slippage, cost overrun, and shortfall in anticipated system functions and features. Shortcomings such as these are more likely from organizations with a software development maturity rating below level 2 (i.e., the repeatable level). Therefore, to minimize software development risks, we continue to believe that VBA should delay any major investment in software development unless it is required to sustain day-to-day operations, until a maturity rating of level 2 is reached.

Regarding the remaining four recommendations, we are pleased to see that VBA is already initiating positive actions, including acquiring the assistance of the Software Engineering Institute.

VA Comments on SCE Results for AAC

VA stated that we did not demonstrate a willingness or flexibility in relating AAC documentation products, activities, and terms to the SEI terms. We reviewed all documentation provided to us by VA including the documents listed in their comments on our draft report. As called for by the SCE methodology, we carefully compared all this documentation to the SEI CMM criteria. As stated throughout our report, we found some strengths but in many cases, VA's documentation was not commensurate with that called for by the SCE methodology. Our comments on the specific key process areas follow.

Requirements Management	The VA comments stated that the OFM/IRM Business Agreement, dated September 1994, contains guidelines which mandate the management of software requirements. However, in our review of the documentation listed under requirements management (Enclosure 1: Documents Addressing Key Process Area), we found no evidence that these documents addressed any of the goals of this KPA. For example, (1) the allocated requirements are neither managed, controlled, nor baselined, and (2) no software development plans were developed based on the allocated requirements.
Software Project Planning	VA feels that the AAC Business Agreement and the negotiated quarterly contract satisfies this KPA; however, we found that AAC does not perform a majority of the activities required to meet the goals within this KPA. For example, AAC was not able to submit evidence for estimating software size and cost, nor did AAC demonstrate any methodology used for estimating schedules.
Software Project Tracking and Oversight	VA stated that project size and risk remain consistent throughout the development/implementation cycle. However, AAC did not provide our SCE team with any evidence validating this assertion and, as discussed on page 8, AAC does not track this information.
Software Subcontract Management	VA claims that specific written policies and procedures are followed when managing software contracts; however, AAC staff interviewed were unable to provide us with any specific policies or procedures used for software contracting. The AAC staff acknowledged that they do not track (1) software contractor performance at the coding level (i.e., track functionality only) or (2) contractor produced software documentation. Regarding training for software contract management, VA stated that its COTRs receive training in procurement, project management, and evaluating contractor performance. However, there is no indication that these courses are specific to software contracting. In addition, other individuals involved in establishing the software contract for the projects reviewed had not received contract management training related to software.
Software Quality Assurance	VA states that its ADP System Integrity Guide, dated September 1994, contains detailed procedures directing the SIS group in specific SQA functions. Although this is a good first step, the AAC is still deficient because it does not have project specific software quality assurance plans that are implemented for individual projects, as required by this KPA within the CMM. Furthermore, we were not provided with any evidence

Software Configuration
Management

showing that the ADP System Integrity Guide has been officially issued or whether its use will be mandatory or discretionary.

The VA comments do not present any additional evidence that would help to satisfy the criteria for this KPA. Specifically, communication between the SIS, AAC staff, and customer do not substitute for the rigor and discipline of a software configuration control board, which VA acknowledged they do not have. Furthermore, the placement of software code under configuration management is not sufficient to satisfy this KPA because other software work products—such as system design specifications, database specifications, and computer program specifications—are also required. Finally, although the AAC does maintain a library of those software work products that it does produce, the products are not maintained under a formal software configuration management discipline, which would include version control and rigorous requirements traceability.

We are sending copies of this report to the Chairmen and Ranking Minority Members of the House and Senate Committees on Veterans Affairs and the House and Senate Committees on Appropriations; the Secretary of Veterans Affairs; and the Director, Office of Management and Budget. Copies will also be made available to other interested parties upon request.

This work was performed under the direction of William S. Franklin, Director, Information Systems Methodology and Support, who can be reached at (202) 512-6234. Other major contributors are listed in appendix IV.

Sincerely yours,

A handwritten signature in black ink, reading "Gene L. Dodaro". The signature is fluid and cursive, with the first name "Gene" and last name "Dodaro" clearly legible.

Gene L. Dodaro
Assistant Comptroller General

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Abbreviations

AAC	Austin Automation Center
CMM	Capability Maturity Model
KPA	key process area
SCE	software capability evaluation
SEI	Software Engineering Institute
SIS	Systems Integration Service
SQA	software quality assurance
SQ&C	software quality and control
VA	Department of Veterans Affairs
VBA	Veterans Benefits Administration
VETSNET	Veterans Services Network

Comments From the Veterans Benefits Administration

Department of
Veterans Affairs

MEMORANDUM

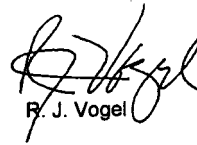
DATE: MAY 21 1996

FROM: Under Secretary for Benefits (20)

SUBJ: GAO Draft Report, Software Capability Evaluation: VA's Software Development Process is Immature, File #1953D

TO: Inspector General (53)

1. Attached are the Veterans Benefits Administration's comments on the recommendations contained in GAO's draft report on the evaluation of software capability.
2. Questions may be referred to Newell Quinton, Chief Information Officer, who can be reached on 273-7004.



R. J. Vogel

Attachment

**Comments from the Department of Veterans Affairs
Veterans Benefits Administration
MAY 1996 GAO Draft Report, Software Capability Evaluation: VA's
Software Development Process is Immature**

GAO Recommendation: Delay any major investment in software development beyond that which is needed to sustain critical day-to-day operations until the repeatable level of process maturity is attained.

VBA Response: While VBA agrees that a repeatable level of process maturity is a goal that must be attained, we disagree that all software development beyond that which is day-to-day critical must be curtailed. The payment system replacement projects, the migration of legacy systems and other activities to address the change of century must continue. As described in our response to the other GAO recommendations in this report and in previous correspondence, VBA has taken actions to incorporate the GAO recommendation in an immediate action plan as well as a longer term approach to reaching a repeatable level of maturity. Additionally, VBA's recent development efforts have resulted in the successful delivery of highly sophisticated client server applications which have assisted VBA field operations. We are confident that, with the help of the Software Engineering Institute (SEI) of the Carnegie-Mellon University and contracted Software Maturity expertise, we have taken steps to lay the foundation and build the context for a sustainable, measurable improvement effort.

GAO Recommendation: Obtain expert advice to assist VBA in improving their ability to develop high-quality software, consistent with criteria promulgated by the SEI.

VBA Response: The VBA has already taken action to obtain expert advice software process improvement. In March 1996, the Chief Information Officer commissioned a Software Process Group to work with SEI. This group serves as the operational focal point for the improvement effort. They have had several planning sessions with SEI to identify activities that will leverage on other improvements already underway. SEI will assist in the development of an integrated set of software practices that position VBA for successful, lasting improvements. They will help to formulate an improvement program and will provide expertise in executing improvement activities.

In addition to the VBA Software Process Group, we are chartering a Management Steering Group to provide a link at the management level that ties to VBA enterprise level performance objectives and to ensure that the improvement efforts will be sustainable.

GAO Recommendation: Develop an action plan, within 6 months from the date of this letter, that describes a strategy to reach the repeatable level of process maturity.

VBA Response: We understand that lasting change occurs incrementally. We are committed to developing a plan to insure successful implementation of lasting improvements. With this objective, we have adopted the SEI IDEAL model, a five-phase cyclical software process improvement program:

- > Initiating Phase
- > Diagnosing Phase
- > Establishing Phase
- > Acting Phase
- > Leveraging Phase

The phases are generally consecutive and we estimate that the length of time it takes to complete a cycle through the five phases of the model will take at least 15 months.

SEI will be facilitating an Improvement Planning Workshop to assist VBA in developing a Software Process Improvement strategic plan. The SEI will provide support to VBA in formulating and initiating detailed software process improvement plans that address the findings of the GAO evaluation through:

1. Conducting the Improvement Planning Workshop.
 - a. Identify specific improvement initiatives for the Level 2 Key Process Areas.
 - b. Develop an initial list of actions to complete plans.
2. Providing technical support in producing and launching the improvement plan.
 - a. Produce tactical action plans.
 - b. Establish measurable goals.
 - c. Establish Tactical Working Groups.
3. Providing technical support to VBA in implementing software process improvement plans produced during the previous phases. Mentoring key individuals in the working groups to establish key organic capabilities. Supporting working members who lead improvement efforts on pilot projects.

GAO Recommendation: Implement the action plan expeditiously.

VBA Response: VBA is well into the Initiating Phase of the IDEAL model. We are drafting charters for the Software Process Group and the Management Steering Group, attending the 1996 Software Process Engineering Group Conference, and making arrangements for SEI support described above. The results of the GAO's SCE have been

shared among the software development management and staff. The GAO SCE results have been used to establish the baseline and will be augmented by an informal assessment of best practices employed by the organization. This will provide immediate assistance to ongoing software development projects in incorporating best practices in a consistent manner.

GAO Recommendation: Ensure that future software development require the contractor have at least CMM Level 2.

VBA Response: VBA has a competitive procurement, scheduled for award in May/June 1996, for software development contract services. The VBA Technical Assistance and Programming Support (VTAPS) contract requires offerors to utilize the SEI Process and Capability Maturity Model approach as necessary. In their proposals, each offeror devoted significant space to detailing their experience with the SEI/CMM approach either for other contracts/clients or as a part of their internal corporate culture. They could be scored twice for this effort: once in the "experience" factor where they describe previous work in this area for other clients; and, again in the "management strength" factor if they had incorporated SEI processes into their corporate procedures. The Acquisition and Review Staff will ensure that future task orders incorporate the SEI CMM emphasis.

Comments From the Department of Veterans Affairs

Note: GAO comment supplementing those in the report text appears at the end of this appendix.



DEPARTMENT OF VETERANS AFFAIRS
ASSISTANT SECRETARY FOR MANAGEMENT
WASHINGTON DC 20420

May 24, 1996

United States
General Accounting Office
Accounting and Information Management Division
Washington, DC 20548

SUBJ: Software Capability Evaluation: VA's Software Development Process Is Immature
(GAO/AMID-96-90) (Assignment Control Number 689767)

1. This is a follow-up to my earlier, interim response to your May 14, 1996, letter to the Secretary on your draft report entitled Software Capability Evaluation: VA's Software Development Process Is Immature (GAO/AMID-96-90). My response will only address the parts of your report that relate to the Austin Automation Center (AAC), which is under my organization. A separate letter has been sent to you regarding the Veterans Benefit Administration (VBA) activities.
2. The attachment states why we disagree with the Government Accounting Office (GAO) findings. In addition, the Deputy Assistant Secretary for Information Resources Management met with the GAO team and also discussed why she didn't agree with the GAO conclusions. The AAC has been in the software development business for almost 30 years. During that time they have very clearly demonstrated their abilities to deliver quality and timely products. In addition, they have demonstrated that they are very cost effective at what they do. The track record of the AAC demonstrates that they consistently have repeatable software development processes. They do not experience schedule delays, cost overruns, or poor quality software, which were organizational traits your package attributed to work groups that do not have the discipline to ensure that repeatable processes are used.
3. All reviews and meetings by VA staff come to the same conclusions regarding the GAO analysis and conclusions. VA thinks the GAO approach to the AAC review was too narrowly focused on specific terms tied directly to the Software Engineering Institute's (SEI) software capability evaluation (SCE) method, which was used by the SEI-trained GAO staff members. They did not demonstrate a willingness, nor flexibility in relating AAC documentation products, activities, and terms to the SEI terms. The AAC received no credit for any processes due to what I think is a human communication issue.
4. Although there doesn't appear to be any direct correlation between your findings in this review, for both VBA and the AAC, and the VBA Modernization Project, I wanted to take this opportunity to clarify a couple of points. VBA is proceeding with their Modernization efforts. Most of that software development will be done by contractors and will not utilize software development staff or processes at the Hines Data Processing Center. Certain components of the VBA Modernization System will reside and run at the AAC. In this case, the AAC will be providing the hardware platform along with operational support activities. Like Hines, they will not be developing any of the

Appendix II
Comments From the Department of
Veterans Affairs

software for VBA Modernization. My reason for surfacing both of these points is to ensure that there is no confusion on the VBA Modernization Project as it relates to the GAO review.

5. The AAC has robust and dynamic processes in place for software development, which they are continually improving upon. I have asked them to consider working with a software engineering firm to assist them in their ongoing assessment of their software development processes. Should you have any questions feel free to call me at 202-273-5589.

Sincerely yours,


for D. Mark Catlett

Attachment

Attachment

**Comments on GAO Findings on Department of Veteran's Affairs Austin Automation Center
Software Capability**

1. Recently the Austin Automation Center (AAC) participated in a review by General Accounting Office (GAO) of our software development process. VA has reviewed the findings, conclusions, and recommendations that were provided and disagrees with the conclusions drawn by GAO because they were based on a rigid interpretation of our documentation use and limited review of two software development projects.
2. AAC staff provided GAO with hard copies of the AAC's organization policies, procedures, and example documents used in our software development process in advance of their visit and during their review we provided them with additional copies of these documents. (See Enclosure 1 - Documents addressing key process area.) GAO failed to correlate our organizational policy documents into their model for software capability evaluation (Capability Maturity Model). (See Enclosure 2, Comments Regarding GAO Audit, for an explanation of how AAC policies and procedures are well documented from an organizational perspective. The first cited weakness in five of the six key process areas related to the lack of documentation reflecting the organization as a whole. This resulted in the conclusion reached by GAO that our software development environment was not mature and not formally documented at the organizational level. I strongly disagree with this conclusion.
3. The findings and conclusions did not address the results or products developed from our existing processes which have a very high level of customer satisfaction, both in terms of quality of product produced and also in terms of product performance. The AAC has over 40,000 time-sharing customers and responsibility for 90+ applications; customer satisfaction is the most important goal.
4. The AAC has very robust and dynamic processes in place for software development which is continually being improved upon. Consideration will be given to working with a software engineering firm that would assist us in assessing and enhancing our software development capabilities.

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DOCUMENTS ADDRESSING KEY PROCESS AREA

The following documents were provided to GAO 2 weeks prior to the AAC staff interviews.
The policies and processes followed by the AAC are grouped by key process areas.

Requirements Management

<u>Document Number</u>	<u>Document Name</u>
A	Business Plan
B	Business Agreement
C	Upward Mobility
D	MultiTrak Instructions
R	Sample PAs
Y	Info/Master Change Control System
Z	COBOL Coding Standards
AA	Promotion Plan
AH	LAN PA Instructions
AI	Summary for OLDE On-Line System
AN	Service Agreement

Software Project Planning

<u>Document Number</u>	<u>Document Name</u>
B	Business Agreement
D	MultiTrak Instructions
E	Service Request Worksheet
F	322 Workflow
M	Strawman
O	EOY Procedures
P	Installation Call
Q	Counterproposal
R	Sample PAs
S	Final PAID Contract
V	Staff Time Utilization
X	Capacity Review
AB	PAID Calendar
AC	Significant Happenings
AD	Service Request
AG	Certification and Installation
AJ	Statement of Work
AK	AAC Financial Modeling
AM	ADP Systems Integrity Guidelines

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Software Project Tracking and Oversight

<u>Document Number</u>	<u>Document Name</u>
B	Business Agreement
D	MultiTrak Instructions
G	SWAT Meeting Notice
J	Quarterly Report
K	EOM Status Report
N	SWAT Report
O	EOY Procedures
T	Service Level Agreement
U	Spreadsheet
W	PAID Workload Tower
Y	Info/Master Change Control System
AE	Audit Exception Report
AF	SWAT Plan
AL	Quarterly Contract Process

Software Contract Management

<u>Document Number</u>	<u>Document Name</u>
B	Business Agreement
D	MultiTrak Instructions
H	Installation Plans
I	Performance Indicators
J	Quarterly Reports
K	EOM Status
M	Strawman
N	SWAT Report
P	Installation Call
Q	Counterproposal
S	Final PAID Contract
T	Service Level Agreement
U	Spreadsheet
AF	SWAT Plan
AJ	Statement of Work

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Software Quality Assurance

Document Number

B
I
J
Y
Z
AE
AG
AM
AO

Document Name

Business Agreement
Performance Indicators
Quarterly Reports
Info/Master Change Control System
COBOL Coding Standards
Audit Exception Reports
Certification and Installation
ADP Systems Integrity Guidelines
Austin Automation Center Trends

Software Configuration Management

Document Number

A
B
E
L
R
Z
AD
AP

Document Name

Business Plan
Business Agreement
Service Request Worksheet
Endevor Instructions
Sample PAs
COBOL Coding Standards
Service Request
Configuration Requirements for FMS
Release 4.0.6J

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COMMENTS REGARDING GAO AUDIT

The General Accounting Office (GAO) observed in their audit that the Austin Automation Center (AAC) does not successfully manage their software projects, software contracts, software quality assurance, or software configuration management. The first cited weakness in five of the six key process areas related to the lack of documentation reflecting the organization as a whole. We disagree with the conclusion drawn by GAO and offer the following

During GAO's interviews, the OFM/IRM Business Agreement, dated September 1994, was supplied for review and was referenced by the interviewees. This document is a living document which is subject to regular review, clarification, and amendment to allow for new situations and to improve customer service and product delivery. This document contains carefully set forth guidelines which the AAC mandates for management of software requirements and states specific roles and responsibilities of each participant in the software management process. We believe the Business Agreement establishes a clear policy and sets forth those processes by which software requirements are defined, clarified, managed, and implemented. The following specific examples from the Business Agreement are provided:

Section II, paragraph A: This paragraph states the exact responsibility of the customer (defined as the party responsible for identifying needs and requesting changes to those affected financial systems) from the initial identification of an area which requires modification to the verification of accurate and error free software processes.

Section II, paragraphs B, C, and D: Paragraph B details policy governing the project manager's responsibilities. A very specific list of tasks are contained in this area to ensure there are no misinterpretations. Paragraph C specifies the duties of the AAC which include developing specifications, completing tests in conjunction with the Financial System Integrity Service (SIS), and furnishing those results to SIS. Paragraph D contains the responsibilities of the SIS Division which include examining and testing functional correctness of the modification, verifying implemented program modifications conform with changes requested in the Service Request (SR) and Project Assignment (PA), etc.

Section III: This section contains documented policies which govern the contract process; the required milestones are precisely and thoroughly detailed. This section also states the control required for each phase of a PA included on the quarterly contract. Realizing that AAC operates in a dynamic environment, the authors of this document had the foresight to address the processes required when making contract adjustments (paragraph IV.A.6 contains requirements if a PA has to be removed from the current contract).

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Section IV: This section contains the policies which govern the contract process. GAO states one strength is "The Business Agreement establishes a process for negotiating the quarterly "contract"." Although the process for negotiation is vital to the AAC's mission, the actions which are set in motion by contract negotiations are much more than just determining what modifications will be on the contract; as one example, the AAC in conjunction with SIS uses this process to project human resource availability. Paragraph IV.F contains specific tasks and the dates by which PAs must be accomplished. These milestones are adhered to by the AAC staff, and SIS; if a milestone cannot be met, this document provides guidelines as to the proper handling of that situation.

The following sections (I - VI) identify the key process areas, weaknesses cited, and specific processes/practices which clearly identify the AAC has policies and procedures.

I. REQUIREMENTS MANAGEMENT

- (1) No written organizational policy for managing the software requirements (*see opening paragraphs*)
- (2) Requirements are not managed or controlled (*see opening paragraphs*)

II. SOFTWARE PROJECT PLANNING

- (1) No written organizational policy for planning a software project (*see opening paragraphs*)
- (2) Projects do not have software development plans.

The negotiated quarterly contract, developed following policies and procedures established in the Business Agreement, is the overarching plan under which software is developed. The Business Agreement requires that a SR be developed for each customer request. The SR is a document which contains the specific changes to implement new or existing administrative policy or pay policy. Upon receipt and review of the SR, the AAC initiates an SR worksheet to identify any issues which were not completely addressed in the original SR as well as any other problems with the SR which may have been discovered during review. This worksheet is also used to identify the affected modules and the amount of staff time required to implement the programming changes to the modules. The revision to the SR also includes SIS staff review to ensure their knowledge of any changes necessary for planning purposes. The AAC then develops a PA for each module affected by the change; the PA contains precise actions to be taken to bring the affected module in compliance with the changes.

- (3) No defined methodology is used for estimating cost, size, and schedule.
- (4) Estimates for the size (or changes to the size) of the software work products are not derived
- (5) Estimates for software projects are not derived.

We disagree with GAO's conclusions in portions of this area. The policy contained in the Business Agreement that establishes the processes utilized to develop the quarterly contract is the methodology for scheduling software implementation. We are committed

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to researching current training opportunities (whether formal or informal and whether internal or external) to develop a uniform estimation technique.

See comment 1.

(6) "Contracts" are not binding.

AAC contracts with customers are binding and flexible. The AAC, by the nature of its business, operates in a dynamic environment. The authors of the Business Agreement recognized the quarterly contract as an *ideal* schedule to be followed in most situations; for this reason they incorporated language to allow for contracts (or areas of the contract) to be renegotiated as needed. The contract must have contingencies for unexpected happenings that occur outside the control of the contract parties. The AAC *must* be able to respond to legislative changes or unforeseen customer requests quickly and effectively; if the quarterly contract was established as a binding document, this inflexibility could result in customers receiving only that included in the contract. Items are not removed from the contract, but, per guidelines contained in the Business Agreement, alternative development/installation schedules are negotiated and agreed upon by all involved parties.

III. SOFTWARE PROJECT TRACKING AND OVERSIGHT

See comment 1.

- (1) No written organizational policy for managing the software project (*see opening paragraphs*).
- (2) The software risks associated with cost, resource, schedule, and technical aspects of the project are not tracked.
- (3) The size of the software work products (or size of changes to software work products) is not tracked.

Risk and size of projects are determined prior to agreements for development. Changes which may affect these factors are also addressed prior to acceptance of change orders. Size and risk remain consistent throughout the development/implementation cycle.

IV. SOFTWARE SUBCONTRACT MANAGEMENT

- (1) No written organizational policy for managing software contracts.

AAC systems development staff work in conjunction with the contracting officers and contracting specialists to manage vendor contracts for software development. The systems development staff Contracting Officer's Technical Representatives (COTR) follow specific VA written policy when managing software contracts.

- (2) The work to be contracted is neither defined nor planned according to a documented procedure.

All tasks destined for contractor development is planned and budgeted for well in advance of the award of work. Once a task is identified, a Statement of Work (SOW) is developed. The SOW is reviewed by AAC and SIS staff. The SOW contains the scope of the work to be accomplished, the parameters within which the tasks must be accomplished, and includes milestones for the completion of the tasks. The SOW also

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contains deliverables and time frames in which the vendor must provide those deliverables to the AAC. The awarded work is then treated like other PAs in the overall project to be completed. The COTR works in concert with the AAC project manager to ensure development and monitoring of the work is performed as any other PA within the constraints of the Business Agreement.

- (3) Software managers and other individuals who are involved in establishing the software contract are not trained to perform these activities.

AAC staff are trained at all levels to effectively manage software development contracts. Contracting specialists have received intense specialized training that enables them to effectively carry out their responsibilities. AAC staff who serve as COTRs have completed the following classes: Procurement for Project Managers, Administrators and COTRs; Project Management; Contracting Officer's Representative Course; and Evaluating a Contractor's Performance.

V. SOFTWARE QUALITY ASSURANCE

- (1) No written organizational policy for implementing software quality assurance (SQA) -- guideline usage is discretionary (*see opening paragraphs*).
(2) The SIS group does not participate in other SQA functions, such as the preparation, review and audit of projects' software development plans, standards, and procedures.
(3) Projects do not have software quality assurance plans.

The ADP Systems Integrity Guide, dated September 1994, Chapter 6 contains detailed procedures directing SIS's required actions in their performance of SQA functions. Among those areas which this document directs SIS to monitor include checklists, inspections, walk-throughs, audits, reconciliations, managerial reviews, post implementation reviews, project management, documentation, configuration management, etc. SIS functions are performed during project estimation, development, testing, and implementation phases. This Guide also contains various checklists which may be used in the execution of quality review tasks. The Business Agreement also contains very specific steps with which SIS must comply to ensure the quality of changes being implemented. Section II (*Roles and Responsibilities*), paragraph D states SIS is responsible for examining and testing the functional correctness of all financial computer systems developed, maintained, or processed by the AAC. This paragraph contains primary functions which include the verification of software conformity to published documentation, the assurance of accurate processing and accountability, as well as the verification that software processes are accurate and error free. Section III, paragraph G.1.b addresses responsibilities in the evaluation and assurance of the software quality. All development plans, standards, and procedures contained in the Business Agreement were developed with the assistance of SIS.

- (4) Members of the SIS group are not trained to perform their SQA activities.

All SIS employees have received extensive training in Systems Integrity and Quality Assurance Concepts as well as System Testing and Quality Assurance.

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See comment 1.

VI. SOFTWARE CONFIGURATION MANAGEMENT

- (1) No written organizational policy for implementing software configuration management (SCM) (*see opening paragraphs*).
- (2) No software configuration control board exists.

Although there is not a "formal" software configuration board, AAC staff, SIS, and the customer keep the lines of communication open to ensure specifications contained in the SR and PA are being implemented in accordance with applicable coding standards contained in the Systems Division Handbook 74-2, COBOL Coding Standards and guidelines set forth in the Business Agreement.

- (3) Software work products to be placed under configuration management are not identified except for code.

The SR is a document which contains the specifics on required changes as well as the how and when those changes to administrative or pay policies should be implemented. The SR contains the "big picture" although specific enough so that after the AAC's review and study, the exact modules requiring modification can be determined. When the AAC receives this request, the SR Worksheet is initiated which lists any incomplete areas in the original SR, the scope of the project, the modules affected, and the estimated amount of time to complete the actions. These functions are completed in conjunction with SIS. The AAC then initiates a PA for each module that requires modification. The PA contains exact actions to be taken to a module to implement the requirements contained on the SR. Finally when an assignment is completed and submitted to SIS for quality assurance review, information is provided on the Certification & Installation (C&I) sheet addressing numerous aspects of configuration management.

- (4) No configuration management library system has been established as a repository for software work products.

The AAC has a very large library of software work products for every application. Specifically in the PAID area these work products are in the form of PAs which can be chronologically accessed and date back to 1987. The PAs contain detailed actions taken to modules to bring them in compliance with legislative changes, administrative requirements, and/or problems detected in the modules which required intervention and correction. As PAs are completed, they are added to the library.

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The following is GAO's comment on the Department of Veterans Affairs' May 24, 1996, letter.

GAO Comment

1. This issue is not addressed in our report.

Level 2 Key Process Area Goals

Level 2 KPA	Purpose	Goals
Requirements management	To establish a common understanding between the customer and the software project of the customer's requirements that will be addressed by the software project.	Goal 1 System requirements allocated to software are controlled to establish a baseline for software engineering and management use. Goal 2 Software plans, products, and activities are kept consistent with the system requirements allocated to software.
Software project planning	To establish reasonable plans for performing the software engineering and for managing the software project.	Goal 1 Software estimates are documented for use in planning and tracking the software project. Goal 2 Software project activities and commitments are planned and documented. Goal 3 Affected groups and individuals agree to their commitments related to the software project.
Software project tracking and oversight	To provide adequate visibility into actual progress so that management can take effective actions and when the software project's performance deviates significantly from software plans.	Goal 1 Actual results and performances are tracked against the software plans. Goal 2 Corrective actions are taken and managed to closure when actual results and performance deviate significantly from the software plans. Goal 3 Changes to software commitments are agreed to by the affected groups and individuals.
Software subcontract management	To select qualified software subcontractors and manage them effectively.	Goal 1 The organization selects qualified software subcontractors. Goal 2 The organization and the software subcontractor agree to their commitments to each other. Goal 3 The organization and the software subcontractor maintain ongoing communications. Goal 4 The organization tracks the software subcontractors' actual results and performance against its commitments.

(continued)

Appendix III
Level 2 Key Process Area Goals

Level 2 KPA	Purpose	Goals
Software quality assurance	To provide management with appropriate visibility into the process being used by the software project and of the products being built.	Goal 1 Software quality assurance activities are planned. Goal 2 Adherence of software products and activities to the applicable standards, procedures, and requirements is verified objectively. Goal 3 Affected groups and individuals are informed of software quality assurance activities and results. Goal 4 Noncompliance issues that cannot be resolved within the software project are addressed by senior management.
Software configuration management	To establish and maintain the integrity of products of the software project throughout the project's software life cycle.	Goal 1 Software configuration management activities are planned. Goal 2 Selected software work products are identified, controlled, and available. Goal 3 Changes to identified software work products are controlled. Goal 4 Affected groups and individuals are informed of the status and content of software baselines.

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