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PATENT AND TRADEMARK OFFICE

Inadequate Contractor Transition Risks
Increased System Cost and Delays

Inspection Report No. OSE-10084-8-0001 / December 1997

Office of Systems Evaluation

DEC 1 9 1997

MEMORANDUM FOR   Dennis Shaw
                   Chief Information Officer
                   Patent and Trademark Office

FROM: Judith J. Gordon
                   Assistant Inspector General for Systems Evaluation

SUBJECT: Final Inspection Report, *Inadequate Contractor Transition Risks
                   Increased System Cost and Delays*
                   (Report No. OSE-10084-7-0001)

The Office of Inspector General conducted an inspection of the Patent and Trademark Office's
new approach for acquiring information systems. PTO has taken a major step toward changing
its approach by replacing its long-standing Litton/PRC prime systems contract for the
Automated Patent System (APS) with the new System Development and Maintenance (SDM)
contract, which was awarded to two contractors in February 1997 and is valued at $511 million
over eight years. This is our final inspection report examining PTO's preparedness to transfer
system activities to the new SDM contractors.

In our draft report, we noted that even though some progress has been made, the transition of
PRC's system development and maintenance activities to the SDM contractors had not been
receiving the time and attention it required and that immediate actions were needed to take
advantage of PRC's limited availability before its contract expired. PTO concurred with three
of our six recommendations. Most importantly, PRC's contract has been extended from
September 30 to the end of December 1997, giving the SDM contractors more time to learn
about APS from PRC. We understand that PRC's assistance during this extended period has
been invaluable in fixing APS problems. Another important recommendation with which PTO
agreed was to rapidly complete developing APS configuration management procedures so that
the SDM contractors would be able to access and manipulate the APS application code in an
efficient, orderly fashion. We understand that incomplete configuration management
procedures have turned out to be a significant issue in the SDM contractors' ability to perform
their tasks. PTO has also agreed to use lessons learned in this transition for the transfer of non-
APS systems in the future.

PTO disagreed with our recommendations that certain steps be taken to improve transition management. It also disagreed that it needed to improve the quality of transferred APS documentation and application code, and APS training of the SDM contractors. The primary purpose of these recommendations was to have PTO establish a team knowledgeable about transition issues, including PRC and the SDM contractors, that would be proactive in identifying the priority issues and solutions in the limited time remaining before PRC leaves. We believe that such an approach would have reduced the risk of using both out-of-date documentation and application code whose accuracy was not verified through testing. It also would have maximized the use of PRC's time and PTO's limited resources. Because of the new contractors' unfamiliarity with APS, solutions to operational problems may be delayed and resources may be diverted from developing systems important to achieving PTO's performance goals. However, with PRC's contract extension expiring soon, PTO lacks sufficient time to implement these recommendations.

PTO also questioned the scope of the report. Because the transition was underway and soon to be completed, we limited the inspection to evaluating whether PTO had made adequate preparations for the SDM contractors to assume PRC's APS *development and maintenance activities*. Specifically, we reviewed three aspects of the transition that were directly related to system development and maintenance: (1) transfer of APS materials, (2) training of the SDM contractors , and (3) preparation for configuration management. We did not address the transfer of other PRC activities, which started in 1991, to contractors other than the SDM contractors. We acknowledge that these other transfers reduced PTO's reliance on PRC. However, we stand by our findings that PTO relies even today on PRC's knowledge of APS and that more preparation could have mitigated some of the problems that the SDM contractors are already encountering.

We made minor changes and clarifications to the report on the basis of updates provided by PTO in its response and recent discussions about transition progress with PTO, PRC, and the SDM contractors. PTO's response to our report is included as Attachment A.

We want to thank PTO for its cooperation and assistance during this inspection.

BACKGROUND

PRC has been PTO's prime systems contractor for the APS since 1984. Working together, PTO and PRC have automated major portions of the patent examination process. However, considerable effort still remains to fully deploy APS and automate the handling of patent applications. APS is crucial to PTO's business of examining and disseminating patents. It allows examiners, attorneys, and the public to electronically search patent databases and enables PTO to

service orders for patent (and trademark) documents. PTO has relied on PRC for almost every aspect of planning, development, deployment, and maintenance of APS.

To improve project management and contractor performance, PTO has embarked on a new system acquisition approach. Part of this approach is to replace its 13-year PRC contract with a new SDM contract. This contract, valued at $511 million over an eight-year period, was awarded on February 12, 1997, to two contractors, Lockheed-Martin and Computer Sciences Corporation. The purpose of the SDM contract is to consolidate APS and various non-APS system contracts and to improve contractor performance by maintaining ongoing competition for tasking. The two SDM contracts officially started on May 15, 1997. Initially, the SDM contractors are expected to assume development and maintenance responsibilities currently being handled by PRC. PRC's contract was scheduled to expire on September 30, 1997 (but has now been extended for three months). The Chief Information Officer (CIO) is responsible for the SDM contracts as well as for transferring existing system activities to the SDM contractors.

Transition of PRC work activities to PTO and the new SDM contractors entails transferring (1) *work materials*, such as software, system documentation, and development support tools; (2) *institutional knowledge,* including crucial design tradeoffs made to meet performance goals and methods used to isolate operational problems; and (3) *responsibilities* for managing the system life cycle, such as configuration management (that is, control of software, hardware, and documentation throughout the system life cycle). The goals for the transition are to provide accurate, complete material for the new contractors to work with; to reduce the contractors' "learning curve" through training; and to put into place system life cycle procedures and support tools so that the contractors can begin working productively when tasking begins. To succeed, the transition must involve the incumbent contractor, the new contractors, and PTO.

PURPOSE AND SCOPE

The purpose of this inspection was to determine whether PTO was prepared to transfer system activities from PRC to the new SDM contractors. This report is based on meetings with the Chief Information Officer; CIO staff involved with the transition; CIO system line managers; PRC's program and deputy program managers; and the program management staff of the two SDM contractors. We also met with the Director of Communications and Information Systems for Galaxy Scientific Corporation, a system support contractor under the CIO's direction. Finally, we reviewed numerous PTO documents, including the APS baseline, APS problem reports, transition plans, and task orders. Our work was conducted in accordance with the *Standards for Inspections* issued by the President's Council on Integrity and Efficiency.

OBSERVATIONS AND CONCLUSIONS

I.   PTO Did Not Adequately Prepare for APS Transition

A well planned and executed transition of PRC's development and maintenance activities is essential because of the importance of APS to PTO business and the magnitude of the transition effort. Although PTO has made some progress, the transition effort lacks sufficient management, planning, quality control, and training. We make recommendations at the end of this report to alleviate problems with the APS transition and to build a better process for transferring other systems to the new SDM contractors in the future.

Transferring the APS work material and PRC's knowledge of the system to the new SDM contractors is difficult because the APS is a large, complex, older system that is undergoing change. It consists of 33 hardware components, 13 major software components, and nine databases organized into a client-server architecture[1] that is held together by a network serving 6,000 users. Because it has evolved over many years, APS is written in numerous programming languages, older portions of it are not well documented, and it is implemented on both old and new hardware platforms. Major efforts are underway to move older proprietary components to newer commercial products and standards. These ongoing efforts also have to be transferred to the new contractors.

The difficulty of transition is further complicated by PTO's reliance on PRC for APS development and maintenance for the past 13 years. Since PRC was the primary developer of APS, its expertise is crucial to understanding how to readily fix operational problems or adapt APS for changes. However, PRC's contract was scheduled to expire at the end of September 1997, and critical PRC personnel have left the APS project. Thus, at the time of our inspection, little time remained to benefit from PRC's dwindling pool of expertise.

APS is crucial to PTO's business of examining and disseminating patents. An inadequate transition could jeopardize APS operations, delay future system enhancements, and increase system costs. Operational problems and delayed enhancements would be detrimental to the patent user community, which consists of patent examiners and administrators, patentees, patent attorneys, and the public. If delays occur, there is also a risk that PTO will postpone future efforts to automate patent application handling. This would jeopardize PTO's performance goals of reducing both patent pendency (the time it takes to grant or deny a patent) and the unit-cost of processing a patent application. Without improved performance, PTO would have to hire more patent examiners to handle an ever increasing workload of incoming patent applications.

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[1] The APS has mainframe and workstation database servers that deliver information to a variety of client computers, including desktop personal computers.

   A. Transition Planning and Management Were Inadequate

In 1995 and 1996, PTO undertook several transition planning efforts that were not implemented. In those years, PTO outlined a transition project in its five-year Strategic Information Technology Plan, which advocated six to nine months of PRC and SDM contractor overlap and extensive quality control of materials. PTO's system engineering and technical assistance contractor developed a transition plan that recommended, among other things, a transition management team, work product quality control, hands-on training, and competency testing. Additionally, PRC identified functional areas to transition and developed a detailed transition schedule in two white papers.

PTO used PRC's transition schedule as a basis for its schedule for transferring material from PRC to PTO. However, PTO's schedule is not as comprehensive or detailed as PRC's. More importantly, PTO did not develop a strategy for evaluating or remedying problems with the transferred material or develop a program for extensive hands on training. At the time of our inspection, several transition tasks had been started, but they were incomplete in the areas of quality control and training. Also, six to nine months were not allocated for PRC and SDM contract overlap. There were at most four months of overlap and even less for most transition tasks, an inadequate period considering the complexity of the system to be transferred. A longer period would have given PRC more time to work closely with the new contractors to transfer institutional knowledge, as well as work materials.

The CIO did not assign a manager with technical knowledge of transition issues to lead the transition effort. Instead, a coordinator was assigned to monitor progress. Decisions were mostly made from the "bottom up" when transition issues arose. For example, a system line manager would discover that transition activities were required and would report this to the transition coordinator, who worked with the acquisition staff to modify task orders to handle the need. Also, a team dedicated to transition was not established. When we suggested that a transition team should be formed and regular meetings held, CIO officials responded that their organization was short staffed and that regular meetings were time consuming and unnecessary.

One reason a more structured transition approach was not instituted is that some CIO staff believed that the transition was not very important because APS availability to users has been very good, its software (especially on the mainframe server) has not recently needed repair, and PTO personnel can fix problems if they occur. While APS availability has been reported to be very good, we believe this is a result of PRC's expertise in handling routine updates of APS databases, installing new releases of the patent text database search engine, and fixing operational problems. After PRC leaves, the SDM contractors may have difficulty with these routine activities. Moreover, problem reports show that APS software has undergone more than 100 repairs in the past 1-1/2 years. In June 1997, 10 new problems were found with the newly implemented and deployed APS personal computer software.

   B. Transition Quality Control and Training Are Inadequate

PTO is not ensuring the quality of transferred system documentation. Although PRC is transferring its APS document libraries to PTO, the documentation is not being checked for completeness or accuracy, and problems are not being corrected. Erroneous documentation will make it more difficult for the new SDM contractors to fix operational problems or enhance the APS. One key document that was out-of-date was the *APS Technical Baseline II*. At the time of our inspection PTO did not plan to update it. The baseline document is the only unified description of APS and the best starting point for understanding the entire system, but it had not been updated with system changes since September 1996. This document is being used to train the SDM contractors. PTO informed us in the response to our draft report that this document has now been updated.

In addition, PTO is not making the extra effort to test the APS generated from software files being transferred from PRC to PTO. It is crucial that these transferred files result in a system that operates identically to the current operational APS. However, PTO is not testing the transferred system. Instead, PTO is compiling and linking the transferred files and then comparing the resulting executable modules against the modules used to generate the current operational APS. This verification technique may not detect some discrepancies and does not test the many interactions that occur during system operation. If the transferred system differs from the operational system, corrections and enhancements to APS will be more difficult to implement, resulting in greater costs and delays.

A final concern with quality control was that PTO did not have a well-defined plan for ensuring that it would receive all the material needed to continue APS maintenance and development after PRC left. PRC had developed an inventory of contract deliverables and additional items. However, it was not clear how PTO was going to ensure that the inventoried items were useful or that the inventory was complete. For example, we found through discussions with CIO staff and a review of task orders that PTO did not have a plan for transferring APS development and test tools that PRC used. Without these tools, the SDM contractors would have to develop their own set of tools, adding time and cost to future system work.   In our follow-up field work, we were informed that in July 1997, PTO system line managers started working with their PRC counterparts to review PRC's inventory and identify useful and missing development and test tools.

SDM training has also been limited. Only two hands-on training tasks were planned for two APS maintenance activities being transferred to the SDM contractors. The only other plans for APS training were two- to four-hour overview lectures for other APS tasks. We believe that more in-depth training, such as design and software walk-throughs for both operational systems and systems under development, should have been provided to adequately prepare SDM contractors to assume PRC development and maintenance activities.

II.   Lack of a Configuration Management Plan Will Impede APS Development and Maintenance

Under the new acquisition approach, PTO will assume overall responsibility for configuration management of both APS and non-APS systems. Configuration management is a discipline, usually implemented with an automated tool and a set of procedures, for controlling software, hardware, and documentation throughout the system life-cycle. It is crucial to system development and maintenance because it controls and tracks access and changes to system components, coordinates work among developers, and provides the means for building system baselines for testing and release. For example, it controls such fundamental functions as who is authorized to access a software module or update a baseline. Without configuration management, system integrity is jeopardized.

A plan that describes procedures and responsibilities for configuration management must be developed to adequately manage system material. A plan is especially important under the SDM contracting approach because configuration management responsibilities, which were handled solely by PRC, will now be shared by PTO and the two SDM contractors. Under this new scenario it is important to define procedures and responsibilities for coordinating modifications to APS between the two contractors, testing modifications, and moving the modified system into operation. However, because PTO has not completed its configuration management plan, the new SDM contractors' work could be delayed.

PTO has made some progress toward instituting configuration management by acquiring an automated configuration management tool, the Process Configuration Management System (PCMS), and by tasking Galaxy Scientific Corporation to transfer the APS software from PRC's configuration management tools to PCMS. However, PTO has not decided whether PRC's configuration management tools or the new PCMS will be used immediately after PRC leaves and the SDM contractors take over APS development and maintenance.

PTO has decided that PCMS will be the configuration management tool that will be used in the future. But, because procedures for using PCMS may not be in place when PRC leaves, PTO may decide to use PRC's tools temporarily. If PRC's tools are used, then the SDM contractors will have to be trained in their use. Currently, this training is not planned. If PTO decides that PCMS will be used, then development and maintenance activities will be delayed until PCMS procedures are defined and tested. In either case, PTO needs to decide quickly where to allocate resources and training for configuration management.

RECOMMENDATIONS

Presented below are our recommendations; to each, we provide a synopsis of PTO's response, and our comments on that response.

We recommend that PTO's Chief Information Officer take the following actions:

1.   Negotiate a limited extension of PRC's contract for systems not transferred before the contract expires, if PRC personnel with relevant experience can be retained.

Synopsis of PTO's Response

PTO concurs with this recommendation. PTO received approval from the Department to extend the contract on May 5, 1997. On September 26, PTO extended the contract to the end of December 1997, primarily for minimal operational support for weekly loads of the patent text database and on-call assistance for any other operational problems.

OIG Comment

Even though PTO had approval to extend PRC's contract, it had not done so at the time of our inspection. We recommended that the contract be extended because not enough time had been set aside for PRC to assist the SDM contractors in becoming familiar with APS. In its response, PTO seems to minimize the benefits of this extension. However, our recent follow-up field work showed that it was fortunate that the contract was extended. Specifically, we found that PRC is providing additional training to assist the SDM contractors in fixing problems with the APS application code.

2.   Take the following steps to improve transition management:

     a.   Appoint a manager and a small team with adequate technical knowledge to understand transition issues.

     b.   Have the team, in collaboration with the SDM contractors, develop a list of activities needed to transition systems, including transfer of development and test tools.

     c.   Have the team, in collaboration with the SDM contractors, develop procedures and criteria for ensuring the quality of transferred system material and training.

> **d.   Have the team define responsibilities and the schedule for completing the transition.**
>
> **e.   Chair regular meetings to review progress, identify problems, and ensure prompt problem resolution.**

Synopsis of PTO's Response

PTO disagrees with this recommendation. PTO believes its current management approach and planned activities are adequate to complete the transition and does not plan any changes. PTO also states that it submitted a master transition plan (completed in July 1997) to us and that the SDM contractors received PTO's standard set of development and test tools in June 1997.

OIG Comment

We continue to believe that PTO needed to change its approach to managing the transition in order to mitigate transition weaknesses and efficiently utilize PRC's expertise in the limited time remaining before its extended contract expires. We recommended that PTO establish a team knowledgeable about transition issues (such as configuration management, quality control, training requirements) and dedicated to the transition effort. Such a team would have enabled PTO to be proactive—identify transition issues up-front—rather than dealing with problems as they arise. However, as stated in its response, PTO is not altering its reactive approach to managing the transition; it continues to rely on a coordinator who works with a matrixed team that divides its time between regular duties and the transition.

Also, PTO states in its response that it is not identifying additional transition activities to shore up loose ends or address the concerns we raise in this report. PTO should have identified new transition activities with the help of the SDM contractors because they could have provided valuable information about what they needed to develop and maintain the APS. PTO did provide us with a master schedule that mostly identifies the dates materials will be delivered from PRC to PTO through the end of PRC's original contract (September 30). It does not address activities during the contract extension. With PRC's contract extension expiring soon, PTO lacks sufficient time to implement this recommendation. However, we believe the CIO should closely monitor progress and provide resources for resolving problems as they arise.

During our field work we were concerned that the APS development and test tools used by PRC would not be transferred to PTO. Through clarification we received in our follow-up work, we were informed that PTO did consult with PRC about development and test tools and that some of the more important ones were transferred.

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3.   **Improve the quality control of transferred material and ensure that important documentation deficiencies are remedied.**

Synopsis of PTO's Response

PTO disagrees with this recommendation. PTO agrees that APS documentation may be inadequate and that there is risk of rework costs. However, it believes that the cost of an exhaustive review would exceed the cost of rework. In its response to our findings, PTO states that it received an updated *APS Technical Baseline II* document on September 25, 1997. PTO also states that APS application code was transferred to PCMS, the new configuration management system, for completeness. Application code that runs on the mainframe will remain in its current configuration management system.

OIG's Comments

We believe that PTO's approach to ensuring the completeness and accuracy of transferred APS material (application code and documentation) will result in unnecessary risks. PTO should have used its limited resources to identify and ensure the quality of the most important material.

PTO did not update APS documentation (besides the *APS Technical Baseline II*) to reflect the current state of the system. PTO acknowledges that its approach risks incurring "rework costs," but claims that resources were not available to update documentation and questions the benefit of reviewing 13 years of APS. However, we believe PTO, with PRC's assistance, could have identified the most important documents and focused limited resources on reviewing and updating them. In fact, in our follow-up work, we were informed that one SDM contractor has been confronted with using practically indecipherable documentation for fixing APS operational problems. In this case, PRC was called in to assist. However, PTO and the SDM contractors will not be able to rely on PRC for assistance after its contract expires. This could result in increased costs and delays to PTO's patent system programs. With PRC's contract extension expiring soon, PTO lacks sufficient time to implement this recommendation.

During our field work, we were concerned that plans were not in place to update the *APS Technical Baseline II*. PTO has informed us in its response that the baseline document has been updated. While this will provide an up-to-date overview of the APS structure, it does not significantly alleviate the difficulty the SDM contractors will have with the poor quality of detailed system documentation.

PTO's approach of compiling and linking APS application code and then comparing the resulting executable modules against the operational APS modules is one approach for checking accuracy and completeness. However, it is good practice, especially since the APS is crucial to PTO, to confirm the accuracy of these comparisons by testing the transferred system to be sure it operates

identically to the current operational system. PTO could have tested the transferred system against the test suite used to approve the release of a new APS baseline. Lack of testing raises the possibility of introducing errors that complicate APS maintenance and enhancement.

4.   Increase hands-on and in-depth training of the SDM contractors for software development and maintenance.

Synopsis of PTO's Response

PTO disagrees with this recommendation. PTO believes that the SDM contractors have received adequate APS training, as well as training in PTO's method for managing information technology and PCMS, the configuration management system PTO plans to use for APS.

OIG's Comments

Training of the SDM contractors has been limited. In our follow-up work, we were informed that one of the SDM contractors received in-depth training from the vendor of the patent text database search engine (Messenger) and from PRC on tailoring and installing Messenger within the APS environment. (However, because of the complexity of this task, PTO is considering not installing new releases of Messenger.) PRC has also provided hands-on training for the migration of the APS client system to a new operating environment. However, in other task areas, PRC provided only overview training. This training usually consisted of a review of the structure of the system documents, a discussion of technical highlights, and a question and answer period. PRC, in its transition plan, offered extensive APS technical training. One reason PTO did not take advantage of this offer before PRC's original contract expired (September 30, 1997) was that the SDM contractors did not have staff on board to train at that time. PTO should have planned additional training during PRC's contract extension, as we recommended, when the SDM contractors would be more fully staffed. However, PTO has chosen to call in PRC only when problems arise.

We emphasized training, in part, because it could help compensate for the likelihood that an old system like APS would be poorly documented. Based on our follow-up work, we found that our concerns were warranted. PRC has been called in to train the SDM contractors in portions of the APS where the documentation is too poor to provide insight into how to fix problems.

The training the SDM contractors receive in PTO's method for managing information technology and PCMS is helpful, but it will not increase their knowledge of APS. In our follow-up work, we were informed that one SDM contractor was able to reduce the risk of working on an unfamiliar system by hiring two APS programmers from PRC. However, with PRC's contract extension expiring soon, PTO lacks sufficient time to implement this recommendation.

5.   Develop and start implementing a configuration management plan within 30 days, including making a final determination of which configuration management system the SDM contractors will use immediately after PRC leaves.

Synopsis of PTO's Response

PTO concurs with this recommendation. PTO states that a plan has been evolving since July 1993 and that the latest version was released in September 1997. Further, PTO has decided to leave the APS mainframe application code on the mainframe's configuration management system and that all other application code will be configured under PCMS.

OIG's Comment

PTO recognizes the importance of configuration management to software development and maintenance and realizes that its existing plan needs refinement. Our follow-up work showed that PTO is currently resolving issues with PCMS client-server connectivity, SDM contractor access privileges, and the identity of the responsible parties for resolving these issues. These types of issues are usually resolved in the final configuration management plan.

6.   Apply lessons learned to improve the transition process for non-APS systems.

Synopsis of PTO's Response

PTO concurs with this recommendation.

OIG's Comment

PTO plans to use lessons learned in this transition on the transition of non-APS systems in the future.

October 2, 1997

MEMORANDUM FOR   Judith J. Gordon
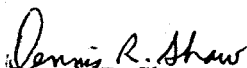Assistant Inspector General for Systems Evaluation

FROM: Chief Information Officer

SUBJECT: PTO Response to Draft Inspection Report, *"Inadequate Contractor Transition of the APS Jeopardizes Cost, Schedule and Performance Goals"*

Thank you for the opportunity to review the draft inspection report on the PTO's Automated Patent System (APS) contract transition activities. As you will see from the attached comments, we have already implemented most of your recommendations. The draft inspection report fails to recognize substantial on-going actions and achievements which began as early as 1991 in anticipation of the transition from the APS contract. The report also does not recognize that the APS contract is being transitioned to several contracts other than the System Development and Maintenance (SDM) contracts including PTO's recently awarded Facilities Management/End User Support contract.

PTO received the draft report on September 9, 1997. With only three weeks remaining on the contract, we were pleased to find that most of the Office of the Inspector General's (OIG's) findings and recommendations were already complete or well underway. Responses to specific observations and recommendations are contained in the attachment.

I've asked Ken Giese to keep your staff informed of our progress as we complete the transition from the APS contract.

Dennis R. Shaw

Attachment

cc: Bruce Lehman
       Ed Kazenske
       Jim Lynch
       Francis Michalkewicz

I. PTO Did Not Adequately Prepare for Transition of the APS

Finding: *PTO did not adequately prepare for the transition of the APS. The OIG also concludes that the transition is further complicated by PTO reliance on PRC for development and maintenance for the past 13 years, and that PRC is the only organization with the expertise to know how to readily fix operational problems or adapt APS for changes.*

PTO's transition planning efforts began in 1991 in the area of system and data base software support. At that time, PTO developed transition plans outlining all work involved in providing ADABAS data base management system, UNIX operating system, IBM operating system and Messenger/FIDO text search data base support. These plans allowed for a two year transition period, during which time, the PRC systems programming staff completed assigned tasks in accordance with strong PTO technical oversight. By the end of 1993, all operating system support functions had been successfully transitioned to PTO. Between 1992 and 1996, PTO also transferred management of 22 software licenses and hardware maintenance contracts in-house.

In 1993 an engineering services contract was awarded to Signal Corporation. Work under this contract enabled Signal to gain expertise on all PTO systems, including those developed and implemented by PRC. This action resulted in a reduction in PRC system engineering support, from $1.2 million annually to $500 thousand by 1996. In 1995, the network engineering task for development of the integrated network was transitioned from PRC to Signal. This integrated network will replace the legacy routed network with a high speed ATM switching network. This work will ultimately be transitioned to PTO's System Engineering and Technical Assistance (SETA) contract. The only remaining engineering support from PRC is for the Optical Storage Devices. However, in-house staff have been trained and have acquired the knowledge to support these devices until they are retired in June 1998.

Further transition activities have occurred relating to the desktop workstations (DWS). Computer Sciences Corporation (CSC) has already been trained to support the current DWS application software and there are no plans for any additional development at this time. The current DWS application software will be replaced, in the first quarter of FY 1998 with the Global Patent Information Client and NT Image Search Retrieval. Signal developed the Global Patent Information Client. Signal is now an SDM subcontractor. NT Image Search Retrieval was developed by PRC, with direct and extensive involvement of PTO and Microsoft Consulting Services, and documented specifically to be turned over for SDM support and enhancement. Desktop deployment services performed under the APS contract have transitioned to the Facilities Management/End User Support (FM/EUS) contract awarded to CBSI.

Finding: *Transition planning and management were inadequate. PTO did not implement a transition plan or follow a strategy, nor was a manager assigned, with technical knowledge of transition issues, to lead and be responsible for the transition effort. Instead a coordinator was assigned to monitor progress. System line managers would identify transition activities and report them to the coordinator.*

In February 1997, a full time transition project manager from the Acquisition Management Division was assigned to provide daily direction and coordination of all remaining transition activities. Prior to that, the transition project manager from the Software Product Assurance Division was assigned on a part time basis. PTO employs matrix management for the majority of its information technology projects. The matrix management team included the APS task order managers who have always had responsibility for the work performed under their task orders. PTO believes that it is appropriate for these same individuals to be responsible for identifying transition requirements. Task order managers conducted regular meetings within their organizations to identify transition activities.

In addition, the APS Contracting Officer's Technical Representative (COTR) holds regular, weekly meetings with PRC and the PTO task order managers, where status of transition activities are discussed.

Finding: *Transition quality control and training are inadequate. Adequate quality control of transferred APS software is questionable, and PTO is not ensuring the quality of transferred system documentation. The APS Technical Baseline document is out of date and has not been updated since September 1996. The lack of an inventory of what needs to be transferred is a concern. SDM training has been limited.*

PTO has captured, in its configuration management tool - Process Control Management System (PCMS), the application code of the portions of APS that operate under the UNIX and Windows NT operating systems. The application code was built to verify completeness, compiled and linked to produce executables to demonstrate the configuration management- captured materials are complete for the UNIX and Windows NT-based APS subsystems. For the application code of the portions of APS that operate on the IBM mainframe, control of all of PRC's configuration management holdings have been transferred to the PTO, including the Library Management Facility. Additional mainframe skills have been hired to augment configuration management of mainframe application software. PTO does not plan to use PCMS as the authoritative source for the IBM mainframe application code because the mainframe is being replaced in FY 1999. PTO will use the Library Management Facility to perform this function. PTO will capture the application code of the replacement patent search system in PCMS. Also, when systems were identified as critical, PRC staff were interviewed to augment collected information. An example is the Weekly Patent Load Software, parts of which run on IBM mainframe, UNIX servers and desktop computers. The configuration management-captured materials were augmented, and missing parts identified and captured, by interviewing knowledgeable PRC staff.

APS documentation has been transferred and placed under configuration management control. The Technical Baseline II is updated annually. An addendum to the Technical Baseline II was provided by PRC on September 25, 1997. Many APS documents are old and provide historical value only. The PTO does not have the resources and expertise to perform an in-depth review of every APS document created over the past 13 years. PTO does not believe it is necessary to do such an in-depth review, but acknowledge that there is a risk of rework cost. PTO believes the cost and time to perform an in-depth review and update of the old APS documents exceeds the cost of potential rework.

A PRC developed inventory does exist. Because PTO in the past left integration and configuration management up to PRC, PTO had no authoritative inventory independent of PRC. Efforts like building the APS UNIX application software allowed PTO to identify gaps in PRC's lists and extract more information from PRC.

Concerning "PRC development and test tools", the SDM contractors are contractually required to use the PTO standard system development tool set which includes PCMS - the configuration management tool. PTO plans to maintain configuration management of all application code in the future and not leave it to a contractor. The addition of the APS application code is a continuance of enterprise configuration management activities which began in July1993 aimed at establishing an enterprise configuration management function for all contractor and in-house developed application software. The PTO plans to avoid the undesirable position in the future whereby a contractor has sole control of its application code.

The APS contract is being replaced primarily by three new contracts, SDM, SETA and FM/EUS. A transition support task was awarded to PRC to provide on-the-job training to technical personnel of the PTO and SDM and FM/EUS contractors. The FM/EUS contractor, CBSI, has been receiving orientation and training since May of this year in areas of operational support, hardware deployment and the weekly issue load. Also in May, both SDM contractors received a half day overview of APS and the APS Technical Baseline. Lockheed Martin began receiving training on Messenger support in July and attended two weeks of training at the Chemical Abstracts Service (CAS) in Columbus, Ohio and then an additional three weeks of training at PRC. CAS is the developer of Messenger - PTO's primary patent text search tool. CSC began training on APS legacy code in August and that training is completed. PRC staff will be available for on-call consultation services through December 31, 1997.

II. Lack of Configuration Management Plan Will Impede APS Development and Maintenance

Finding: *PTO has not developed a configuration management plan, nor have they decided which configuration management tool will be used immediately after PRC leaves.*

PTO recognizes that improvement is needed toward implementing an enterprise configuration management program. PTO is establishing a disciplined configuration management process and procedures for all its system development efforts. PTO first drafted an enterprise configuration management plan in July 1993 and pilot the use of PCMS as the enterprise configuration

management tool in November 1994. Since the initial plan was drafted, PTO has concentrated on developing processes and procedures for implementing configuration management using PCMS. These procedures were first published in PTO's Technical Standards and Guideline on Configuration Management in July 1995 and used for selected new AIS projects. PCMS went into full production use in June 1996. The Configuration Management Technical Standard and Guideline is an evolving document and has been improved over time. PTO has encountered resistance to change from both in-house developers and contractors supporting the PTO and has experienced difficulty in adequately staffing the software product assurance function and obtaining sufficient funding due to mandated FTE ceilings and budget reductions.

PTO's Software Engineering Process Group (SEPG) identified configuration management as its most significant concern in June 1997 and established a team to revise configuration management procedures. The revised configuration management procedures were presented to PTO's Technical Review Board on July 24, 1997 for review and approval. The Board directed several actions to improve configuration management training, configuration management procedures for developers and operational support of PCMS. On September 24, 1997, the TRB approved SDM contractor production use of PCMS and directed that procedures to control the check-in and check-out of work in process configuration items be clarified. The TRB will review how well the configuration management procedures are working in early November.

PCMS is PTO's approved configuration management tool and its use was specified in the SDM Request For Proposals. CSC is currently learning PTO's implementation of PCMS for configuration management. Some Lockheed Martin staff have been trained to use PCMS; however, Lockheed Martin is not yet using the tool as the company is experiencing start-up problems and has not been able to provide staff for the task orders assigned.

RECOMMENDATIONS

PTO provides the following responses to the Office of the Inspector General's recommendations:

1. **Negotiate a limited extension of PRC's contract for systems not transferred before the contract expires, if PRC personnel with relevant experience can be retained.**

PTO asked the Department of Commerce for approval for a three month extension of the PRC contract. On May 5, 1997, the Department approved an extension to the contract through December 1997. PTO and PRC agreed to a contract extension on September 26, 1997. The primary emphasis of the extension is to provide a minimum effort for operational support associated with the Patent Weekly Load function and provide on-call assistance for any other operational problems. The Patent Weekly Load function is being transitioned to the FM/EUS contract with CBSI.

2. **Take the following steps to improve transition management:**

   a. **Appoint a manager and a small team with adequate technical knowledge to understand transition issues.**

A full time transition project manager was assigned in February 1997. PTO applies matrix management using a team of task order managers to manage the transition efforts. The matrix management approach appropriately places responsibility on those task order managers who are responsible for the function supported rather than a separate team.

   b. **Have the team, in collaboration with the SDM contractors, develop a list of activities needed to transition systems, including transfer of development and test tools.**

Transition activities have been identified and a schedule developed and tracked in the PTO's project management system. Transition activities for individual APS task orders were identified and entered into PTO's project management system by May1997. PTO completed a master transition plan on July 16, 1997 and provided the plan to the OIG staff. The SDM contractors are required to use PTO's standard set of development and test tools. PTO's system developer tool set was made available to the SDM contractors in June 1997. CSC is using the system developer tool set. Lockheed Martin will be using it as soon as they provide staff for assigned tasks.

   c. **Have the team, in collaboration with the SDM contractors, develop procedures and criteria for ensuring the quality of transferred system material and training.**

The SDM contractors are developing contract-wide quality assurance and configuration management plans, which will address procedures and quality control for both the transfer of material and training.

   d. **Have the team define responsibilities and the schedule for completing the transition.**

The responsibilities have been identified in PTO's transition plan and the schedule tracked in the PTO project management system.

   e. **Chair regular meetings to review progress, identify problems and ensure prompt problem resolution.**

The transition manager meets weekly with the CIO. In addition, the APS Contracting Officer's Technical Representative (COTR) holds regular, weekly meetings with PRC and the PTO task order managers, where status of transition activities are discussed. The COTR weekly meetings with task order managers will continue with the SDM contracts.

3. **Improve the quality control of transferred material and ensure that important documentation deficiencies are remedied**

PTO has received final delivery from PRC of all APS documentation. PTO agrees that document deficiencies need to be remedied for those documents that are relevant for SDM contractor use. Many APS documents are old and provide historical value only. The PTO does not have the resources and expertise to perform an in-depth review of every APS document created over the past 13 years. PTO does not believe it is necessary to do such an in-depth review, but acknowledges that there is a risk of rework cost. PTO believes the cost and time to perform an in-depth review and update of the old APS documents exceeds the cost of potential rework. Should problems arise during the three month APS contract extension period, PTO will rely on PRC for consultation services.

4. **Increase hands-on and in-depth training of the SDM contractors for software development and maintenance.**

PTO has trained SDM contractors. The training includes PRC briefings, the Managing Information Technology (MIT) training series, and hands on PCMS training. The MIT training series educates PTO's information technology employees in the methodologies and processes that help support PTO and business area mission, goals, and objectives. Lockheed Martin contractor personnel have received Messenger training from the Chemical Abstracts Service. The MIT training series educates PTO's information technology employees in the methodologies and processes that help support PTO and business area mission, goals, and objectives. However, concerning system developer tools, the SDM contract requires the contractor to already possess knowledge and skills in the use of PTO's system developer tool set.

5. **Develop and start implementing a configuration management plan within 30 days, including making a final determination of which configuration management system the SDM contractors will use immediately after PRC leaves.**

An enterprise configuration management plan has existed since July 1993 and has been revised to reflect transition work, SDM contractor responsibilities, and lessons learned over the past four years. The latest version of that plan, dated September 18, 1997 has been reviewed by PTO's Technical Review Board. Procedures have also been developed, including change process, pocket guide and technical standards and guidelines. PTO specifically stated in the SDM Request For Proposals that the contractors would use PCMS as the configuration management tool. PTO will continue to use the Library Management Facility tool as the authoritative source for APS mainframe application code. PTO does not plan to add functionality to the APS mainframe applications and will replace the IBM mainframe in FY 1999. PTO believes that it is not cost-effective to control the APS mainframe application code in PCMS and notes that most of the Messenger/FIDO code is developed by Chemical Abstracts Service and is proprietary. PTO has been negotiating a separate contract with the Chemical Abstracts Service.

6. Apply lessons learned to improve the transition process for non-APS systems.

PTO agrees that lessons learned from the APS transition should be applied to any future transition efforts.