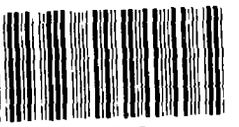
GAO

Report to the Chairman, Committee on Government Operations, House of Representatives

August 1987

# TRADEMARK ADP SYSTEM

# Patent Office Should Analyze Alternatives Before Contract Award

GAO

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

**Information Management and**
**Technology Division**

B-217448

August 27, 1987

The Honorable Jack Brooks
Chairman, Committee on Government Operations
House of Representatives

Dear Mr. Chairman:

This report is the second in response to your March 9, 1987, request to review certain automatic data processing (ADP) activities at the Department of Commerce's Patent and Trademark Office (PTO). Our first report described the status of contract renegotiations for the automated patent system.[1] This report addresses your request that we review the need and justification for the procurement of replacement hardware and software for the automated trademark system, for which a Request for Proposals was issued in September 1986. PTO estimated that this procurement would cost about $22 million. PTO expects to award the contract on August 28, 1987, but recently amended the Request for Proposals. The amendment extends the deadline for making modifications to offers to September 30, 1987.

Significant objectives of the September 1986 Request for Proposals were to obtain more processing capacity, consolidate the work load of three computers on to one computer system, be able to use the trademark search software on the new computer system, develop a system to maintain images of trademarks, and update existing software. The procurement was intended to place PTO in a position to integrate duplicate trademark data bases and software as part of its strategy to meet its long-term goals.

In May 1987, PTO modified the procurement strategy in its September 1986 Request for Proposals to immediately relieve the capacity problems of its Burroughs-7700 computer when it found that its trademark search software could not be fully operational on the new computer system for about 22 months. Although its procurement strategy changed, PTO did not analyze any alternatives other than acquiring a large computer system with sufficient capacity to meet its original objectives.

[1] ADP System: Patent Office's Contract Renegotiation Behind Schedule, GAO/IMTEC-87-35, July 31 1987.

Such an analysis is required by federal regulations[2] to determine the alternative with the lowest overall cost. PTO officials believe that their problems with computer capacity were so critical that they did not have time to conduct this analysis. We found that PTO's computer capacity problems are not as severe as officials believe them to be and there is sufficient time to conduct an analysis of alternatives. Further, the dimensions of PTO's computer capacity problems are not fully defined because it does not have an effective program for computer capacity planning and performance management. We recommend that PTO (1) properly analyze its alternatives and their costs for relieving computer capacity problems, before awarding a contract, and (2) establish a computer capacity planning and performance management program.

We conducted our review from June to August 1987. Our audit work focused on the need and justification for PTO's proposed trademark computer system replacement as planned under the modified Request for Proposals. Appendix II discusses our assignment scope and methodology.

## Background

Three computers currently support patent and trademark operations. The Burroughs-7700 computer provides most of the day-to-day, on-line[3] support for examiners as they process patent and trademark applications. For trademarks, this support consists primarily of monitoring the status of trademark applications. The computer's work load is about 50-percent patent,[4] 40-percent trademark, and 10-percent administrative processing. The Burroughs-6900 computer is used for batch-processing work and for development, testing, and maintenance of computer programs. The IBM-4341 computer operates the on-line trademark search system, which searches existing trademarks to help examiners determine if the same or similar trademarks have already been applied for or are registered. The data base used on the IBM-4341 computer contains the same data as the trademark data base on the Burroughs-7700 computer. PTO's major long-term goals for trademark automation are to integrate duplicate data bases and eliminate redundant data, automate quality assurance, enhance the reporting and monitoring system that

[2] Federal Information Resources Management Regulation (FIRMR), 41 C.F.R. 201-20.003, 201-30.009 (1986).

[3] On-line processing provides users with the capability to input or obtain data directly from a computer system.

[4] PTO plans to move the patent work load to the new Automated Patent System in approximately 1992.

maintains records of trademark ownership, improve management and quality of data bases, and increase the cost-effectiveness of trademark operations.

Significant objectives of the procurement, when the Request for Proposals was issued in September 1986, were to:

- acquire a computer system with sufficient processing capacity to replace the existing Burroughs-7700, Burroughs-6900, and IBM-4341 computers;
- move the duplicate trademark data bases, which are being operated and maintained on both the Burroughs-7700 and the IBM-4341 computers, to the new computer system;
- update patent, trademark, and administrative software to meet COBOL 74 standards;[5]
- be able to use a software system called ORBIT, now operating on the IBM-4341 computer, on the new computer system to search the trademark data base and provide information to users; and
- develop a registration page system to maintain digital images of the original trademark registration and all subsequent modifications.

In May 1987, PTO changed its strategy after it found, while proposals were being evaluated, that the ORBIT system could not be fully operational on the new computer system for about 22 months. PTO's ADP Coordinating Committee decided on May 13, 1987, to modify the original Request for Proposals by withdrawing the requirement that ORBIT operate on the computer systems proposed by offerors. This modification prevented PTO from being able to consolidate the work load of the IBM-4341 computer on the new computer system. The Committee also decided to withdraw the requirement for development of a registration page system, which was intended to provide clearer images of trademark registrations, because of its unexpectedly high costs and the perception of PTO officials that the public demand for this new capability had diminished. PTO estimates that the modified procurement will cost between $20 and $25 million, about as much as its $22 million estimate for the original procurement.

As a result of these changes, the modified procurement will replace only two of the three computers (Burroughs-7700 and Burroughs-6900) and

[5]COBOL 74 is the latest standard approved by the American National Standards Institute for the Common Business Oriented Language (COBOL), a computer programming language

provide for updating the patent, trademark, and administrative software. The IBM-4341 computer will not be replaced and its data base will not be moved to the new system, the ORBIT search system will not be acquired for the new computer, and the registration page system will not be developed. The Assistant Commissioner for Finance and Planning and the Administrator for Automation told us that PTO is beginning to study the upgrades that will be needed to continue operating the ORBIT search system on the IBM-4341 computer.

PTO's Assistant Commissioner for Finance and Planning said that PTO plans to begin a study of the feasibility of integrating the trademark data bases and software. The Assistant Commissioner said he expects that if integration proves to be feasible, PTO will begin implementing the integration in 1990 or 1991 as planned.

## PTO Has the Opportunity to Explore Other Alternatives Before Proceeding With the Current Procurement

PTO changed its original procurement strategy to a strategy of relieving immediate capacity problems on the Burroughs-7700 computer after it realized that it could not attain its original procurement objectives. According to the Assistant Commissioner for Finance and Planning, the decision to continue with a modified procurement was driven by PTO's critical problems with the capacity of the Burroughs-7700 computer. The Assistant Commissioner said disk capacity for the Burroughs-7700 would be reached by September or October 1987 and there is no more floor space in the computer center to add more disk drives; response times are unacceptable to the users; and computer down time, aggravated by electrical power surges, is high. This official also said that the disk storage problem is the most critical problem, and is the primary reason why the Burroughs-7700 computer must be replaced as soon as possible.

The decision to continue with the procurement under the changed strategy was not based on a comparison of alternatives and their costs as required in the Federal Information Resources Management Regulation (41 C.F.R. 201-20.003, 201-30.009 (1986)) for all ADP procurements. The Assistant Commissioner for Finance and Planning said PTO did not have time to perform an analysis of alternatives. The Assistant Commissioner said PTO had to decide quickly on a course of action because of Burroughs-7700 computer capacity problems, the most pressing of which was the lack of disk storage capacity. Insufficient disk storage would jeopardize PTO's ability to process patent and trademark applications. The Assistant Commissioner also said PTO did not formally analyze other alternatives or their associated costs because it believed the objectives

of the modified procurement were not a significant change from the original procurement objectives.

## Short-Term Disk Storage Capacity Is Sufficient

While analyzing the problem of disk storage capacity on the Burroughs-7700 computer, we found that seven recently installed disk drives had not yet been used. As of August 12, 1987, these disk drives were being tested and would be made available to store data, according to the shift operations supervisor. According to the chief systems programmer, PTO's data base has been growing at a rate of about five disk drives per year. At this rate, PTO's currently installed disk drives are sufficient for another year.

The chief systems programmer also said that, although the computer could handle more disk drives than are currently installed, lack of floor space would prevent their installation. We looked at the computer center floor space and found an area next to the disk drives about 4 feet wide and 20 feet long that is used primarily for storage cabinets. This space would be sufficient for eight more disk drives if the storage cabinets were moved to other areas of the computer room where space is available. The Deputy Administrator for Automation agreed that there is sufficient floor space for eight more disk drives.

## Computer Response Times Are Unsatisfactory to Users but Are Not Causing Significant Work-Load Backlogs

The Assistant Commissioner for Trademarks told us that the Burroughs-7700 response times are not acceptable. The Deputy Assistant Commissioner agreed and said users have been complaining that response times are too long. The Deputy said some staff have complained that they are not able to meet official work performance standards because of slow response times.

We analyzed PTO's computer performance data for the 12-month period of June 1986 to May 1987. PTO's records showed that during the period the overall monthly average response time was 10.6 seconds and ranged from a low of 6.6 to a high of 18.2 seconds. For 8 of the 12 months, the average response time was 10 seconds or lower. We could not determine the extent to which response times for the Burroughs-7700 computer system met PTO's standards. The Assistant Commissioner for Finance and Planning told us he recalled that the response-time standards were between 2 and 5 seconds. The chief systems programmer said he was not aware of any official response-time standards for the Burroughs-7700 computer. PTO's monthly response-time reports do not list response-time standards for the Burroughs-7700.

Although response times are not acceptable to users, the Deputy Assistant Commissioner for Trademarks told us that there are only small work-load backlogs because PTO has taken actions such as removing word processing and text editing functions from the computer to compensate for the slow response times.

In analyzing the response times of the Burroughs-7700 computer, we explored the effect that leveling the on-line work load would have on the computer's response time. Work-load leveling would involve managing employees' working schedules with the objective of processing a steady stream of transactions throughout the day to avoid overloading or underusing the computer system, although achieving a perfectly level work load would be difficult to accomplish. Our analysis of daily average response times during the month of April 1987, a typical month according to the Deputy Assistant Commissioner for Trademarks, showed that the average response time would have dropped 23 percent from the 7.9 seconds actually experienced to 6.1 seconds for a perfectly level work load. Our analysis also showed that the average hourly work loads followed the normal business pattern of peaks in the midmorning and midafternoon, and lower usage early in the day, at midday, and during the late afternoon. (Appendix I discusses our analysis and analytical methods in more detail.) The Assistant Commissioner for Finance and Planning agreed that work-load leveling has the potential to improve the computer's performance. He said he had discussed work-load leveling with other PTO officials, but no actions have yet been taken to use this method of improving computer response times.

## Computer Hardware Problems Are Not a Major Cause of Computer Down Time

In analyzing the down time of the Burroughs-7700 computer for the 12-month period ending May 1987, we found that the computer's overall availability was 95.5 percent. For 8 months of that period, computer availability ranged from 96.5 to 99.4 percent, which exceeded PTO's monthly standard of 95 percent. For the remaining 4 months, the Burroughs-7700 computer did not meet PTO's monthly availability standard because it fell below the requirement of being operational 95 percent of the time.

**Table 1: Burroughs-7700 Computer—Substandard Availability, June 1986 Through May 1987**

| Month | Time Available | Major Reason Standard Not Met |
|---|---|---|
| August 1986 | 91.0% | Power Surge |
| December 1986 | 86.1% | High Temperature (cooling tower problem) |
| April 1987 | 92.3% | Computer Hardware Problems |
| May 1987 | 92.0% | Computer Hardware Problems |

As shown in Table 1, a power surge and high temperature were the primary causes for not meeting the standard during August 1986 and December 1986, respectively. While power surges do occur, they do not appear to be a major reason why the computer falls below PTO's availability standard. The computer failed to meet PTO's availability standard for only 2 months of the 12-month period ending May 1987 because of problems with the computer hardware itself. In these months, the computer's availability was 2.7 and 3 percent below standard.

## PTO Did Not Analyze Alternatives to Current Procurement

The objective of overcoming immediate computer capacity problems is significantly different from the original procurement objectives and affects the computer hardware and the work load to be processed. According to the September 1986 Request for Proposals, the procurement was intended to replace the Burroughs-7700 computer which maintains a data base of about 620,000 active trademark registrations and has four central processing units (of which one is for on-line reserve) and about 6.5 million bytes of memory; the Burroughs-6900 computer used for batch processing and software development having one central processing unit and about 6.5 million bytes of memory; and the IBM-4341 computer, which searches its data base of about 620,000 active trademark registrations and has one central processing unit and 8 million bytes of memory. The September 1986 Request for Proposals called for replacing these three computers with multiple computers that have at least 36 million bytes of memory and that could be split into smaller, independent systems. Each of these smaller systems would have access to at least one-third of the total system resources. The Request for Proposals also called for developing the registration page system. In May 1987, PTO withdrew the requirements for processing the work load of the IBM-4341 computer, with its large data base, and developing the registration page system. PTO did not, however, change the technical specifications in the Request for Proposals for the replacement computer. Because the work load of the IBM-4341 computer will not be transferred to the new computer, PTO will continue operating and maintaining this system. Also, as previously discussed, the Assistant

Commissioner for Finance and Planning told us that PTO is beginning to study the upgrades needed to continue operating the trademark search system on this computer.

The Federal Information Resources Management Regulation (41 C.F.R. 201-20.003, 201-30.009 (1986)) requires an analysis of alternatives with their costs to determine which alternative will meet users' needs at the lowest cost over the system's life. We have previously reported that PTO has not adequately assessed costs before acquiring ADP systems.[6]

Although its stated procurement objectives changed to solving its computer capacity problems on the Burroughs-7700 computer, PTO did not consider any alternatives other than acquiring a large computer system with sufficient capacity to meet its original objectives. For example, PTO did not formally analyze alternatives such as reducing the work load of the Burroughs-7700 computer by transferring some of the work load to a new computer or the Burroughs-6900 computer; acquiring a small computer to support the software development staff now using the Burroughs-6900 computer and moving the patent work load to the Burroughs-6900 computer; or replacing only the Burroughs-7700 computer with a somewhat larger computer. The project manager of the automated trademark system unofficially estimated that an analysis of alternatives would take from 2 to 3 months to complete.

## PTO Lacks an Adequate Computer Capacity Management Program

During our review, we found that PTO does not have a formal computer capacity planning and performance management program. PTO has made some changes to improve the performance of the Burroughs-7700 computer such as reallocating computer memory, rebuilding data base pathways, and moving files to balance disk drive work loads. However, PTO does not have a formalized program of measurements, evaluations, and reporting, with specific goals and objectives to maximize productivity and user satisfaction while minimizing costs and forecasting future computer systems requirements. A computer capacity planning and performance management program typically includes assessing computer programs and outputs for efficiency and effectiveness, setting equipment performance goals and a system of measurements, assuring proper

[6] ADP Acquisitions: Patent Automation Encountering Major Planning and Procurement Problems, GAO/IMTEC-86-19, July 17, 1986; Patent and Trademark Office Needs To Better Manage Automation Of Its Trademark Operations, GAO/IMTEC-85-8, April 19, 1985

justification of new equipment by continually measuring current utilization and capacity, and establishing a model to forecast computer system resource needs.

PTO has not clearly defined the causes of its computer performance problems. For example, although PTO collects computer performance data and routinely reports response times to management, it did not analyze response time patterns of the computer to determine exactly when response times were degrading, specifically identify what was causing them to degrade, and how they could be improved.

Actions can generally be taken to improve performance if the causes of problems have been identified. For example, at PTO's request, a contractor suggested certain actions, in March 1987, that PTO could take to improve response times on the Burroughs-7700 computer. After PTO took these actions, the average daily response time dropped 39 percent from 12.8 seconds in February 1987 to 7.8 seconds in March and April 1987. The average response time rose to 17.2 seconds in May 1987, but PTO does not know the cause. The Assistant Commissioner for Finance and Planning agreed that PTO needs to do better in this area and should have a computer capacity planning and performance management program.

## Conclusions

In our opinion, awarding the contract on its current planned schedule is unnecessary because PTO's computer capacity problems are not as critical as it believes. PTO believes that disk storage capacity is an impending crisis, but PTO has disk storage space it has yet to use. Response times and computer availability are not causing work-load backlogs, and PTO has not explored options to improve response times. Also, because PTO does not adequately manage computer capacity planning or performance evaluation, it has not identified the causes of computer performance problems and attempted to correct them.

Although PTO's current procurement objective falls short of meeting its original objective of consolidating the work load of its three computers on to one computer system, the procurement may provide the computer capacity to do this and will cost between $20 and $25 million, about the same as the estimated cost of the original procurement. The decision to change the procurement strategy and focus on relieving capacity problems of the Burroughs-7700 computer was not based on an analysis of alternatives and their costs as required by federal regulations. Such an analysis could be completed in 2 to 3 months, which is almost a year before the installed disk drives will reach capacity.

## Recommendations

We recommend that the Secretary of Commerce require the Commissioner of Patents and Trademarks to:

- Properly analyze PTO's alternatives and their related costs to determine the best solution for meeting PTO's computer capacity problems before awarding a contract.
- Establish a computer capacity planning and performance management program to better ensure efficient and effective use of PTO's ADP resources and to help avoid future performance problems such as those experienced with the Burroughs-7700 computer system.

As agreed with your office, we are sending copies of this report to the Secretary of Commerce and the Commissioner of Patents and Trademarks. We plan no further distribution until 30 days from its issue date. At that time, we will send copies to other interested parties.

Sincerely yours,

Daniel C. White

Ralph V. Carlone
Director

# Analysis of Work Load Volume and Response Times for April 1987

Figure I.1 shows the average number of transactions and response times by time of day for the month of April 1987. Although the computer system's hours of on-line operation are from 6:30 a.m. to 6:00 p.m., the Patent and Trademark Office's (PTO) computer usage data reports statistics in hourly intervals. In order to accurately represent the computer's work load and performance, we analyzed PTO data reported for the workday hours of 7:00 a.m. to 6:00 p.m. The average number of transactions per workday hour was 9,020, with a high of 12,389 (from 2:00-2:59 p.m.) to a low of 2,366 (from 5:00-5:59 p.m.). Response times averaged 7.9 seconds, with a high of 13.97 (from 2:00-2:59 p.m.) to a low of 2.1 (from 5:00-5:59 p.m.). Figure I.1 shows that as the number of transactions rises response times rise. Daily work loads followed the normal business pattern of peaks in midmorning and midafternoon, and lower usage early in the day, at midday, and late afternoon.

We obtained from PTO hourly summaries of transaction volume and response times for April 1987. We calculated for each hour from 7:00 a.m. through 6:00 p.m. (a) the average number of transactions per hour for the month and (b) the average response time per transaction for the month. We then plotted both sets of data on the same graph (figure I.1).

Figure I.2 shows the relationship between average transaction volume and average response times. For a level work load throughout the day of 9,020 transactions per hour, the average response time would be 6.1 seconds, or a 23-percent decrease from the 7.9 seconds average actually experienced in April 1987 (figure I.1).

Using regression analysis, we developed the curve that best described the relationship between the average number of transactions and average response time per hour. The coefficient of determination for this analysis was .90 indicating that 90 percent of all variability in the data is explained by our regression model. The regression curve, which is based on actual observations of average transactions ranging from 2,366 to 12,389, is plotted in figure I.2. Because our regression model does not explain 100 percent of the variability in the data, the true average response time obtained when the work load is 9,020 transactions per hour may differ somewhat from our estimate of 6.1 seconds. We are 95-percent confident, however, that the true average response time at this work-load level lies between 5.2 and 6.9 seconds per transaction.

**Figure I.1: Average Number of Transactions and Response Times by Time of Day**

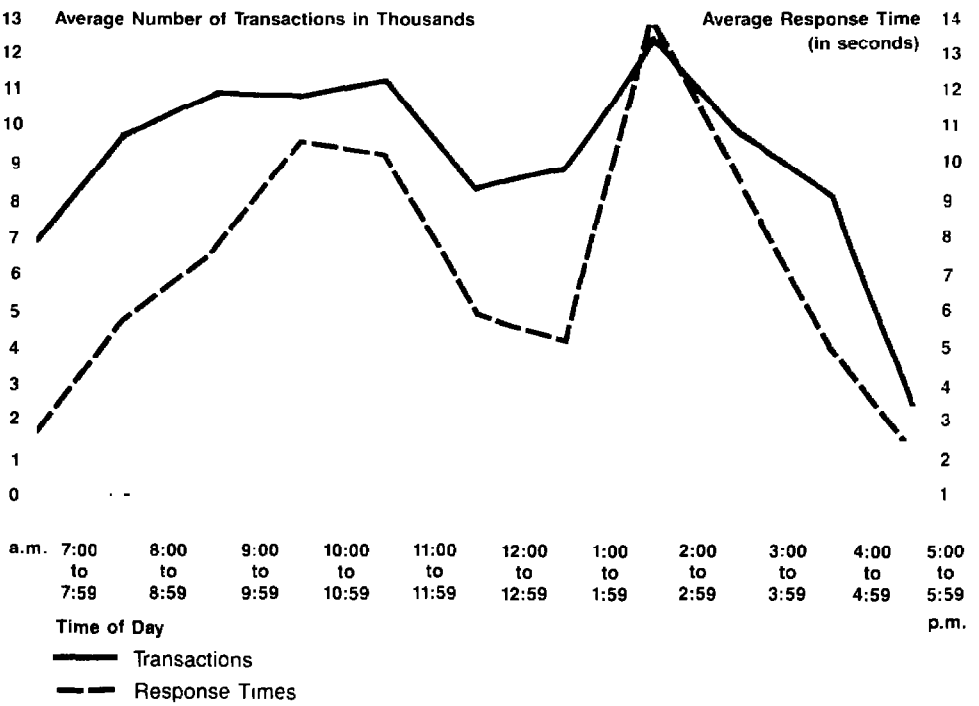
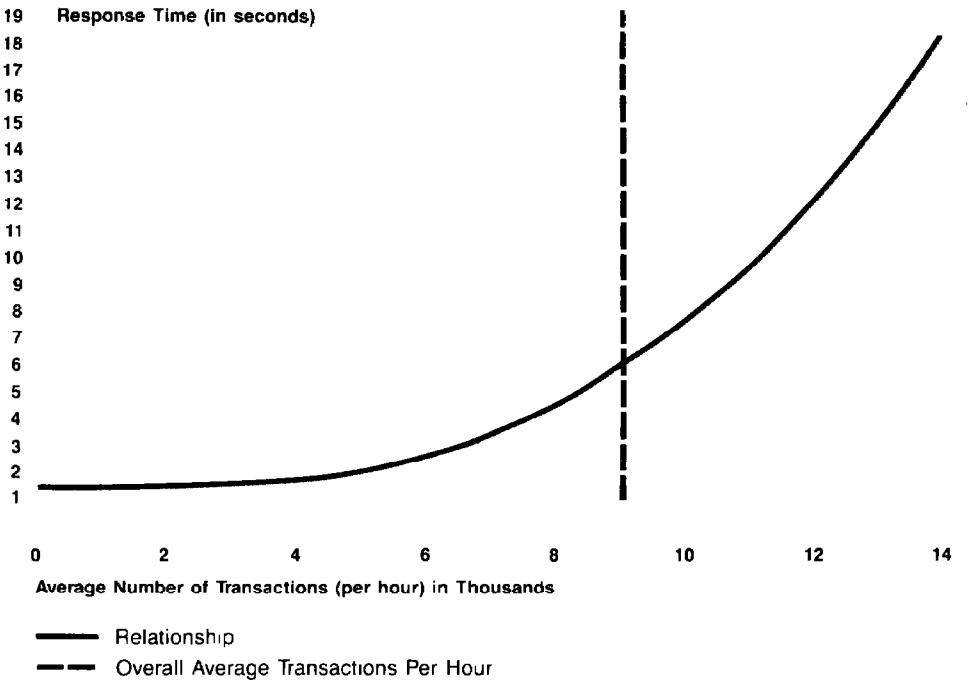


**Figure I.2: Relationship Between Average Transaction Volume and Average Response Time**



# Scope and Methodology

To determine whether the computer replacement is needed and justified, we interviewed senior Commerce and Patent and Trademark Office (PTO) officials from the data processing, contracting, and user staffs. These included Commerce's Deputy Assistant Secretary for Special Programs, and PTO's Assistant Commissioner for Trademarks, Assistant Commissioner for Finance and Planning, and the Administrator for Automation. Our review included an examination of PTO's April 1987 Automation Master Plan, original and current Request for Proposals, contract file, results of a May 1987 risk analysis on the current systems, Request for Proposals justification, and the Federal Information Resources Management Regulation.

We also reviewed the performance of PTO's Burroughs-7700 computer because it provides the main processing support to patent and trademark operations and, according to PTO officials, its critical problems with disk storage capacity are the main reason for proceeding as scheduled with the current procurement. To evaluate the capacity of the Burroughs-7700 computer to process its work load, we analyzed available computer performance data on transactions and response times for the period June 1986 to May 1987, including the average hourly transactions and response times for April 1987 (a typical month, according to the Deputy Assistant Commissioner for Trademarks). In addition, we analyzed the availability of disk drives for the Burroughs-7700 computer system. We also reviewed computer availability data for the year ending May 1987, and obtained information from PTO and the hardware manufacturer on actions taken to improve the efficiency of the Burroughs-7700 computer.

We conducted our review from June to August 1987. The scope of our audit work was focused on the need and justification for PTO's proposed trademark computer system replacement as planned under the modified Request for Proposals. Because negotiations were in progress, we did not evaluate the proposals received and the results of the negotiation process to determine the extent to which proposals met PTO's current computer needs. We discussed key facts in this report with Commerce and PTO officials and have included their comments as appropriate, but did not obtain official agency comments on a draft of the report. Our work was performed in accordance with generally accepted government auditing standards.

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