

GAO

Report to the Chairman, Subcommittee
on Oversight, Committee on Ways and
Means, House of Representatives



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COMPUTER
CAPACITY

IRS Must Better
Estimate its Computer
Resource Needs



RELEASED

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The Honorable J. J. Pickle
Chairman, Subcommittee on Oversight
Committee on Ways & Means
House of Representatives

Dear Mr. Chairman:

In your March 7, 1986, letter you requested that we assist the Subcommittee in its oversight and evaluation of the Internal Revenue Service (IRS). Among other things, you asked us to determine the progress and status of a planned \$186 million computer acquisition known as the Capacity Enhancement for the Processing System (CEPS). You also requested that we perform an analysis of the need for and timing of such a major acquisition, which was designed to upgrade or replace the large mainframe computers in IRS' 10 service centers by 1989. This report addresses the results of our review of these issues and documents a June 27, 1986, oral briefing that we provided to members of your Subcommittee staff.

You also requested that we investigate the performance of IRS' existing communications processors and evaluate the soundness of the planned replacement of those processors. We reported the results of that analysis to you in a separate report entitled Data Communications: Thorough Testing and Workload Analyses Needed for IRS Processors (GAO/IMTEC-87-3BR), October 14, 1986.

The backbone of IRS' tax processing system is the large mainframe computer. In each of the 10 service centers, IRS uses two large mainframe computers to process two primary workloads. One workload consists of checking taxpayer submitted information for mathematical accuracy and completeness, correcting errors, and preparing it for posting to individual and business taxpayer master file accounts. The second workload consists of on-line retrieval of information from the taxpayer accounts in response to communications between IRS and taxpayers.

IRS based the need for CEPS on its belief that the mainframe computers did not have the capacity to handle projected tax processing workloads starting in 1989. The CEPS strategy was designed to acquire an upgraded or replacement system dedicated to handling the on-line

workload. With this new system, IRS believed that the existing mainframe computers would then have sufficient capacity to handle the processing of taxpayer submitted information and the updating of computer files beyond 1989.

While we were conducting our analysis of CEPS, IRS decided not to pursue it. Instead, the agency decided to postpone upgrading mainframe computers until the early 1990s and to make that procurement part of an overall system redesign. IRS has identified a series of initiatives that it believes will not only make better use of the capacity of its existing mainframe computers, but also extend their useful life through the early 1990s. These initiatives include: realigning workloads among service centers; constraining workload growth to a rate of 8-10 percent per year by limiting new applications; further optimizing computer programs; and adding capacity (upgrading mainframes) in those service centers needing more processing power.

Treasury endorsed IRS' decision to abandon CEPS in favor of (1) adopting the initiatives and (2) combining the procurement strategy of CEPS with that of the planned redesign. This redesign effort is called the Tax System Redesign (TSR).¹

Our findings on CEPS are summarized below; details on these findings and on our objectives, scope, and methodology are included in the attached appendixes.

On the basis of available data, we believe that the existing mainframes will have the necessary processing capacity to handle IRS' tax processing workloads through at least mid-1991, assuming that no large unexpected increase in workload occurs and IRS effectively carries out its planned initiatives. However, IRS may find that its initiative to constrain annual workload growth to 8-10 percent will be difficult to achieve because it plans to install new communications processors, expand the terminal network, and introduce new on-line applications that will potentially increase demand for tax account information. If IRS does not constrain workload growth and does not successfully implement the other initiatives, it could experience capacity problems at its larger service centers

¹This TSR strategy, initially endorsed by Treasury, is now being questioned by both Treasury and the Office of Management and Budget. (See appendix II for details.)

as early as mid-1988. An IRS contractor, using slightly different analytical techniques than ours, concluded that IRS will have sufficient computer capacity through 1989 if the initiatives are achieved.

Although our analysis gives a rough approximation of computer capacity needs, a more reliable prediction is critical to computer resource investment decisions. Such a prediction could be developed if the workload processed by the mainframe computers were better delineated. However, beyond ad hoc analyses of workloads to improve the efficient use of the mainframes since the 1985 filing season, IRS has not conducted a comprehensive analysis of its current or future workloads; nor has it assessed the impact that these various workloads will have on its computer resources. At the time of the CEPS procurement proposal, the agency did not believe that there was enough time to conduct such an analysis and still upgrade or replace the system before 1989.

We believe that without this workload analysis, as well as a continuing analysis of current system utilization, IRS will not have adequate assurance that its initiatives are working. As a result, it could unexpectedly find itself short of computer capacity earlier than the end of 1991 when TSR implementation is scheduled to begin. Such an unexpected shortage could have a devastating impact on operations, as was evidenced in the 1985 tax filing season when, among other things, a computer capacity problem was unexpectedly experienced. IRS recognizes the need to perform the analyses and has established an office to do so. However, work by this office has been delayed due to limited staffing with the necessary expertise.

Because of the importance of the mainframe computers to IRS' ability to accomplish its mission and the need for continued improvement in its investment decisions on these critical computer resources, we recommend that the Commissioner of the Internal Revenue Service:

- develop and maintain comprehensive workload data for current and planned automatic data processing (ADP) requirements;
- monitor the performance of the installed mainframe computers to provide a baseline for determining whether the initiatives actually extend the useful life of the existing mainframes and for evaluating alternatives for meeting future ADP requirements;

- analyze the impact of the various workloads on the utilization of the mainframe computers to effectively estimate and plan for future IRS ADP requirements; and
- report to the Subcommittee on Oversight, House Committee on Ways and Means, any significant deviations or delays in the achievement of the initiatives or any other factors that may jeopardize IRS' ability to extend the useful life of its mainframes through 1991.


The first three recommendations are consistent with a recommendation made in our October 14, 1986, report on IRS' communications processors, regarding updating workload projections and monitoring system performance. We believe that the recommendations in both reports must be effectively implemented to ensure that IRS' initiatives extend the useful life of its mainframes and that future acquisitions of computer resources will satisfy IRS' processing needs. However, such implementation is only one of a series of critical steps that IRS must take to ensure that future acquisitions, particularly the Tax System Redesign, are effectively planned and actually satisfy IRS' ADP requirements.

On October 28, 1986, we obtained oral comments from IRS and have incorporated them in the report where appropriate. The agency agreed with the report's findings, conclusions, and recommendations.

As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution until 30 days from the date of the document. At that time, we will send copies to the Commissioner of IRS; the Director, Office of Management and Budget; the Secretary of Treasury; and other interested congressional committees and subcommittees. We will also make copies available to others upon request.

If you have any questions about this report, please call James Watts, Associate Director, Information Management and Technology Division, on 275-3455.

Sincerely yours,



Warren G. Reed
Director

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ABBREVIATIONS

ADP	automatic data processing
CEPS	Capacity Enhancement for the Processing System
CPE	computer performance evaluation
CPU	Central Processing Unit
FIRMR	Federal Information Resources Management Regulation
GSA	General Services Administration
IDRS	Integrated Data Retrieval System
IRS	Internal Revenue Service
NCC	National Computer Center
RFP	Request for Proposals
TSR	Tax System Redesign
UACCMO	User Assistance and Computer Capacity Management Office

INTRODUCTION

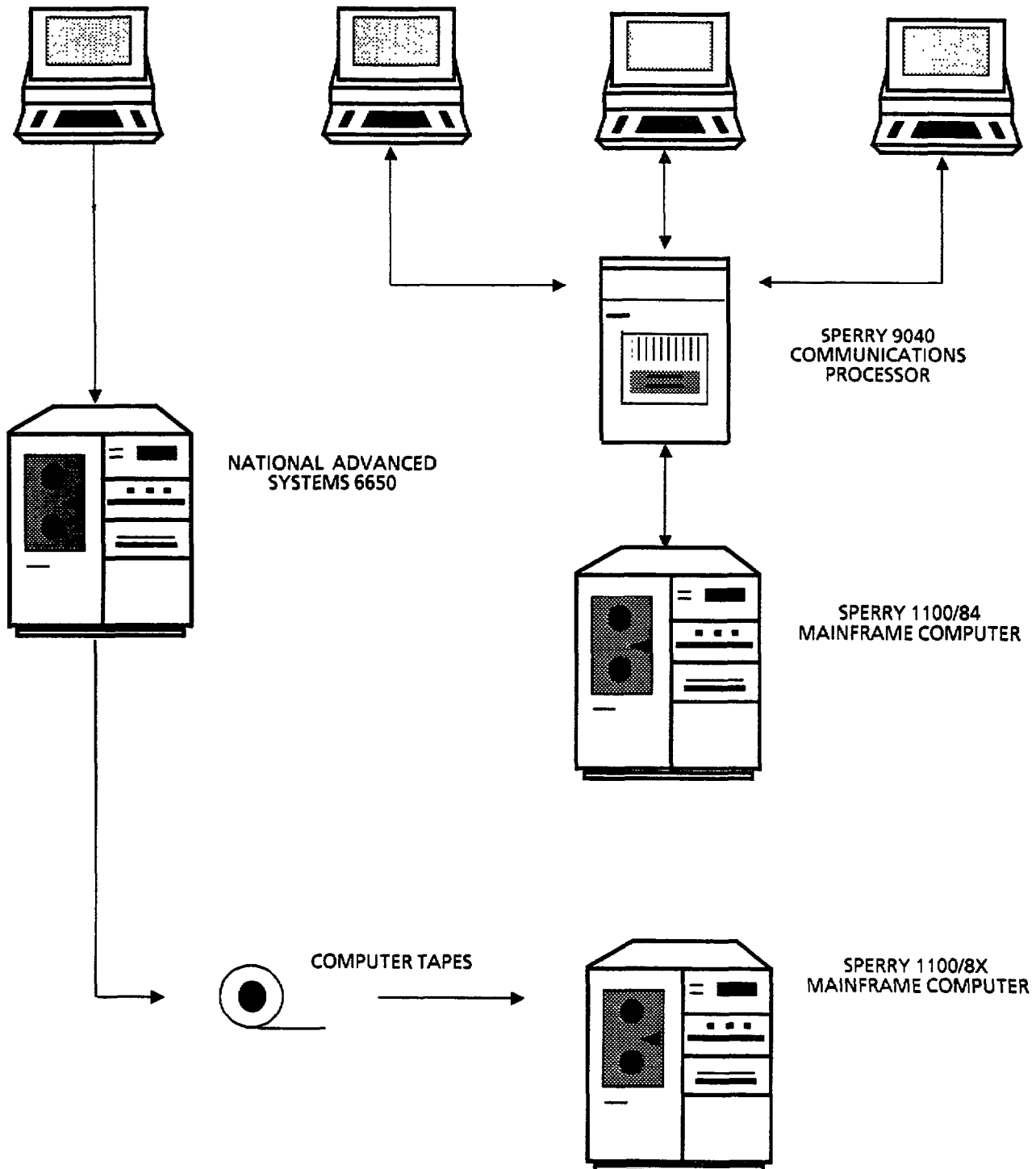
TAX PROCESSING SYSTEM OVERVIEW

DISTRIBUTED INPUT SYSTEM
ENTER TAX RETURN DATA

ERROR RESOLUTION SYSTEM
CORRECT ERRORS

GENERALIZED UNPOSTABLE FRAMEWORK
CORRECT UNPOSTABLES

INTEGRATED DATA RETRIEVAL SYSTEM
EXAMINATION, RESEARCH, ADJUSTMENTS, MISC.



TAX PROCESSING SYSTEM OVERVIEW

The Internal Revenue Service (IRS) is one of the largest users of computers in the federal government. The annual processing of millions of tax returns is highly dependent on automatic data processing (ADP). Thus, the proper management of IRS' ADP resources is crucial for ensuring that the nation's tax laws are administered in an efficient and effective manner. IRS' tax processing system is comprised of independently operated computer networks at its National Computer Center (NCC) in Martinsburg, West Virginia, and 10 service centers nationwide.

As shown in the adjacent chart, the backbone of the tax processing system is the mainframe computer. The mainframe computers, Sperry Univac (herein after referred to as Sperry) 1100/84, 1100/83 or 1100/82, are the computers that process all data related to processing tax returns or used to interface with the taxpayer. (The last number in the Sperry series depicts the number of central processing units in the computer configuration. For example, the 1100/84 has four central processing units and can process nearly twice as fast as an 1100/82, which has two central processing units.)

On-line transactions via computer terminals pass through communications processors to access the key data bases on the Sperry computers. The systems are (1) the Integrated Data Retrieval System (IDRS), which is used to handle active taxpayer accounts, such as collection and examination cases, and taxpayers' inquiries on these accounts, (2) the Error Resolution System, which is used to correct errors found on tax returns during returns processing and errors made by IRS in transcribing information from the returns, and (3) the Generalized Unpostable Framework, which is used to correct conditions that prevent service center processed data from being matched with taxpayer accounts maintained at NCC.

The Sperry mainframe computers are also used to process taxpayer submitted information from the initial tax returns to the taxpayer's master file account. IRS refers to this process as "pipeline" processing. Tax return and payment data are entered initially through the Distributed Input System. This system consists of a series of terminals connected to a National Advanced Systems 6650 computer, which processes and formats data so that it can be processed on the Sperry computer. The output from the National Advanced System are computer tapes, which are input to the Sperry computer.

The transcribed data are checked to determine if they are mathematically accurate and to determine if all the tax data necessary for processing the returns are present and accurately transcribed. Next, computer tapes containing the error-free return information are generated and sent to the NCC where the

information is posted to the taxpayer's master file account. NCC then produces a computer tape, which lists all accounts requiring communication with the taxpayer and accounts that did not post to the master file and need correction. Each service center receives tapes on taxpayers serviced through its districts and inputs the tapes into its Sperry 1100/84 mainframe computer. Through the Sperry mainframes, computer-generated notices are produced informing taxpayers of errors or requesting additional information about their accounts. Errors that prevented posting to the master files are corrected.

IRS officials estimate that approximately 70 percent of all individual returns are processed without error. The other 30 percent need to interact with IRS' error correction systems. These tax returns are processed through the communications processor and corrected using the error correction systems.

CONGRESSIONAL CONCERNS

CONGRESSIONAL CONCERNS ABOUT IRS' CEPS PROCUREMENT:

- THE STATUS AND PROGRESS OF THE CAPACITY ENHANCEMENT FOR THE PROCESSING SYSTEM (CEPS) ACQUISITION
- WHETHER THE CEPS ACQUISITION IS REALLY NEEDED TO SUPPORT THE TAX PROCESSING WORKLOAD STARTING IN 1989 IN LIGHT OF:
 - 1985 COMPUTER PROBLEMS
 - UPGRADE OF COMPUTERS IN 1986

CONGRESSIONAL CONCERNS

On March 7, 1986, the Chairman, Subcommittee on Oversight, House Committee on Ways and Means, requested that we provide information on the status and progress of a planned \$186 million computer acquisition known as the Capacity Enhancement for the Processing System (CEPS). The Chairman also requested that we perform an independent analysis of the need for and timing of this major acquisition. Although IRS believed that its Sperry mainframe computers would not support the tax processing workload starting in 1989 and planned to replace them, the Subcommittee questioned the need for such an acquisition as early as 1989.

The Subcommittee was aware of the problems that hampered the agency's ability to effectively and efficiently manage and control its workloads during the 1985 filing season. These problems, which were linked to the initial implementation of the Sperry mainframe computers, stemmed from a combination of insufficient computer capacity, inefficient computer software, unfamiliarity on the part of IRS employees with the new Sperry computers, unfamiliarity with newly introduced input systems, increased use of the system, and insufficient staff and equipment. In addition, IRS had further upgraded this new computer system prior to the 1986 filing season. The Subcommittee was concerned about the need for yet another system upgrade or replacement as early as 1989.

OBJECTIVES, SCOPE, AND METHODOLOGY

OBJECTIVES

- DETERMINE THE STATUS AND PROGRESS OF CEPS
- DETERMINE THE NEED FOR AND TIMING OF CEPS

SCOPE

- IRS, TREASURY, GSA OFFICIALS
- IRS CONSULTANT (DATAMETRICS SYSTEMS CORP.)
- ACQUISITION DOCUMENTATION
- AUSTIN AND OGDEN SERVICE CENTERS

METHODOLOGY

- REVIEWED THE CHRONOLOGY OF THE ACQUISITION AND THE DECISIONS OF THE OVERSIGHT/APPROVAL OFFICES
- DETERMINED WHETHER IRS NEEDS TO UPGRADE OR REPLACE ITS COMPUTER SYSTEMS FOR THE 1989 FILING SEASON
 - DEVELOPED A MODEL OF IRS' MAJOR PROCESSING ENVIRONMENTS
 - REVIEWED IRS COMPUTER PERFORMANCE ANALYSIS
 - REVIEWED IRS CONTRACTOR'S CAPACITY PLAN STUDY
 - ANALYZED CEPS JUSTIFICATIONS & REQUIREMENTS

OBJECTIVES, SCOPE, AND METHODOLOGY

The objectives of this assignment were to (1) determine the status and progress of the CEPS procurement and (2) conduct an independent analysis of the need for and timing of this planned computer upgrade or replacement. To meet our objectives, we interviewed IRS' computer performance consultant (Datametrics Systems Corporation), as well as cognizant IRS, Department of the Treasury, and General Services Administration (GSA) officials, and reviewed available IRS documentation justifying the planned CEPS procurement. We collected computer performance data during April 1986 from the Ogden, Utah, and Austin, Texas, service centers, and employed analytical modeling techniques to simulate the capabilities of IRS' existing Sperry mainframe computers. We selected these centers because large service centers are typically the first to experience computer capacity problems and request upgraded or replacement computers. We also visited the centers to gain an understanding of the user's perspective and the actual use of the computer performance data that we collected. We performed our detailed review between March 1986 and June 1986 and updated our work with information received in September 1986. Our work was done in accordance with generally accepted government auditing standards.

To determine the status and progress of CEPS, we met with officials at IRS, Treasury, and GSA who were responsible for oversight and/or approval of the acquisition. We also traced the acquisition from the development of its needs through the draft Request for Proposals (RFP).

To determine whether IRS needs to upgrade or replace its computer systems for succeeding filing seasons, we used the following combination of auditing and analytical techniques: (1) developing a simple model of IRS' computer environment; (2) determining what computer performance data was available to support acquisition decisions like CEPS; (3) reviewing the computer performance work done for IRS by Datametrics System Corporation of Burke, Virginia, (hereinafter referred to as Datametrics) through a contract with the Vanguard Technologies Corporation of Fairfax, Virginia; and (4) reviewing IRS' justification and requirements for CEPS.

Our modeling was done using a commercially available model, BEST/1. This nationally known, capacity-planning and performance-tuning tool has been commercially available since 1977. BEST/1 is capable of calculating the performance of almost any computer system on the basis of parameters that characterize the system's hardware, software, and workload.

We developed two models--one to simulate transaction processing during relatively busy daytime periods (on-line) and the other to simulate weekend (batch) processing cycles. Our

models were developed using system performance data from the mainframe computers that primarily handled IRS' daily on-line processing and individual taxpayer account weekend batch updates.

The models simulated the capabilities of IRS' existing processing environment and its ability to handle increased workloads within established periods--between now and 1989 as well as through the CEPS projected system life of 1991 or 1992. While our BEST/1 modeling techniques were applied for daily on-line processing in both Austin and Ogden, the model could not be used to simulate weekend batch processing. To simulate the weekend processing, we collected data on computer performance and performed mathematical analyses of the weekend system utilization while treating the whole weekend as a single batch processing workload. Using this technique, we analyzed the system's performance under various workload scenarios. To ensure the integrity of our work, we compared our analytical techniques with those utilized by both IRS and its independent contractor. They agreed with our approach.

Discussions of the assumptions, methodology, and results of the IRS, Datametrics, and our analyses of IRS' capacity needs are contained in appendix III.

CAPACITY ENHANCEMENT FOR THE PROCESSING SYSTEM (CEPS)

CEPS BACKGROUND

- 1985 PROCESSING PROBLEMS RESULTED IN AN INTERIM UPGRADE OF IRS MAINFRAMES

- CEPS WAS PLANNED AS A FULLY COMPETITIVE PROCUREMENT TO REPLACE THE EXISTING MAINFRAMES USED WHEN ACCESSING TAXPAYER ACCOUNT INFORMATION

- EXISTING MAINFRAMES WOULD BE KEPT FOR ESTABLISHING AND MAINTAINING TAXPAYER ACCOUNTS

- TAX SYSTEM REDESIGN GOALS

CEPS BACKGROUND

In 1985, IRS replaced its obsolete service center computer equipment with Sperry 1100/80 series processors as part of an overall equipment replacement program, which included the procurement of the Sperry mainframe computers as well as conversion of machine language computer programs to a higher level, more easily readable programming language. IRS' difficulty in handling its 1985 processing workload was well-publicized and resulted in IRS measures to improve processing and accessing of taxpayer information. These measures included an interim acquisition of additional Sperry mainframes, which was intended to satisfy the projected tax processing workload through 1988. At that time, the Sperry processors were to be replaced. GSA granted IRS procurement authority for this interim service center upgrade provided that it be followed by a fully competitive procurement to replace the 1100/84 mainframes.

The CEPS acquisition was intended to be the fully competitive procurement that would replace the 1100/84 mainframes for handling the on-line Integrated Data Retrieval System (IDRS) workload starting in 1989. This competitive procurement was based on IRS' belief that the Sperry mainframes would not provide sufficient computer capacity to handle projected tax processing workloads beyond 1988. The remainder of the 1100/84 processing workload--the pipeline processing--was originally planned to be handled through a separate competitive procurement. However, IRS decided to continue handling the pipeline processing workload on the existing 1100/8X processors and to pursue its CEPS plans. Consequently, the agency obtained a Delegation of Procurement Authority from GSA for \$186 million to complete the acquisition. The strategy was to acquire a system for IDRS that would last through 1991 with the workload on the Sperry mainframes diminishing through 1994.

This CEPS strategy was intended to provide IRS with the computer capacity needed to handle its tax processing workloads into the early 1990s when IRS would begin implementing its Tax System Redesign (TSR). This redesign effort is intended to ensure that IRS has the computer capability to meet its needs through the 1990s by providing:

- state-of-the-art technology in hardware, data storage, and data communications;
- faster access to all taxpayer account information;
- linkage of related accounts; and
- automation of manual processes.

STATUS AND PROGRESS OF CEPS

- IRS DECIDED NOT TO PURSUE PLANNED PROCUREMENT
 - TREASURY WITHHELD APPROVAL
 - STEERING COMMITTEE RECOMMENDED A PHASED SOLUTION
- PLANNED IRS INITIATIVES TO EXPAND THE USEFUL LIFE OF THE MAINFRAMES
 - WORKLOAD REALIGNMENT
 - DATABASE PURIFICATION AND DISCIPLINE
 - APPLICATION GROWTH CONSTRAINT
 - APPLICATION/SOFTWARE OPTIMIZATION
 - ADDITIONAL MAINFRAMES IN CENTERS NEEDING MORE COMPUTER CAPACITY
 - OFFLOAD COMPUTER RUNS
- BLEND CEPS GOALS INTO TAX SYSTEM REDESIGN (TSR) STRATEGY
 - REPLACE MAINFRAMES BY 1992 FOR ACCESSING TAXPAYER ACCOUNTS
 - DECENTRALIZE MASTER FILE
 - MOVE TAXPAYER ACCOUNT MAINTENANCE TO NEW MAINFRAMES BY 1995
- RFP FOR TSR PHASE I ISSUANCE IN EARLY 1987

STATUS AND PROGRESS OF CEPS

In April 1986, IRS decided not to pursue the CEPS procurement. Instead, the agency has adopted a series of initiatives to extend the useful life of its existing mainframe computers. By extending the life of its existing mainframes, IRS will not have to undergo another major computer conversion until its Tax System Redesign is implemented.

On February 19, 1986, the Treasury Deputy Assistant Secretary for Information Systems, who has approval authority over IRS ADP acquisitions, withheld approval of the CEPS Request for Proposals (RFP). He questioned whether IRS could substantiate its contention that without a system replacement it would run out of computer capacity at its service centers by 1989. He also questioned whether a major equipment replacement procurement represented the best solution to IRS' perceived computer capacity needs. He believed that a comprehensive system plan was needed before computer capacity needs could be identified.

On April 9, 1986, the CEPS Steering Committee, comprised of three senior service center directors, recommended that the IRS not issue the CEPS RFP in favor of another solution to the capacity problem. The directors believed that the use of the existing computer capacity could be improved to meet the processing needs in the near future and that the agency could immediately begin actions to prepare for its major tax processing redesign effort.

As a result of the Treasury position and the Steering Committee recommendation, IRS decided to pursue the following "stretching-out" initiatives, which it believes will make better use of capacity by doing so. The initiatives will extend the useful life of the service center computers, thus allowing IRS to avoid a major system conversion until implementation of the first phase of its redesign effort in 1991. The "stretching-out" initiatives include the following:

- realignment of the tax processing workloads among the 10 service centers so that no center handles more than 15 percent above the average workload across all centers,
- reduction of the size of its on-line IDRS data base by purging unnecessary or excessive taxpayer account information and maintaining only needed account data,
- constraint of workload growth by limiting new computer application growth to an 8-10 percent annual rate,
- increased efficiency of computer programs for weekend processing by 25 percent,

--addition of computer capacity to those service centers needing more processing power by procuring additional Sperry 1100/8X processors, and

--potential movement of selected computer applications to other available IRS computer systems for processing.

IRS believes that these initiatives will cumulatively extend the useful life of the Sperry system through 1991. Responsibility for the achievement of these initiatives is shared by the Assistant Commissioners (Computer Services, Returns & Information Processing, and Policy, Finance and Research) in conjunction with IRS system users.

If these initiatives are achieved, IRS will not need to replace its current mainframe computers in its 10 service centers. The next change to the mainframe computers will occur as a result of the Tax System Redesign. The current TSR strategy calls for the establishment of three to five new processing centers, instead of 10 service centers, and the procurement of new equipment for these centers. Processing of the (on-line) IDRS workload is scheduled to begin by 1992. In addition, the strategy provides for decentralizing the current master file accounts from the National Computer Center to these same centers, as well as moving the pipeline workload to these centers by 1995.

The Assistant Commissioner (Tax System Redesign) is responsible for developing an RFP for the first phase of TSR by early 1987. This RFP will provide the necessary computers for IDRS processing in the new processing centers as well as for subsequent TSR workloads. The Assistant Commissioner (Policy, Finance and Research) will help to identify potential locations for new processing centers.

IRS' decision to abandon its planned CEPS procurement, in favor of (1) adopting the initiatives to extend the useful life of the current mainframe computers and (2) combining the procurement strategy of CEPS with that of the planned total redesign of the tax processing system, was initially endorsed by the Treasury Deputy Assistant Secretary. However, the lack of IRS progress in developing this TSR strategy has subsequently raised concerns from both Treasury and Office of Management and Budget (OMB). In August 1986, IRS was advised that both questioned the TSR strategy because it appeared to be simply a hardware acquisition rather than a true system redesign. Consequently, IRS was asked, by OMB through Treasury, to develop a management plan for the strategy that would include a systematic analysis of the perceived problem, an analysis of all available alternatives, and a cost/benefit analysis.

We believe that the analyses Treasury and OMB are requiring IRS to develop are important to IRS' ability to define its tax processing system needs in its planned Tax System Redesign RFP.

ANALYSIS OF IRS CAPACITY NEEDS

CAPACITY NEEDS - IRS PROJECTIONS

- CONCENTRATED ON WEEKEND UPDATE PROCESSING
- RELIED UPON INSTITUTIONAL KNOWLEDGE
- AVERAGED 1985 FRESNO PEAK PROCESSING DATA
- ADJUSTED AVERAGED FRESNO PEAK DATA FOR PLANNED:
 - WORKLOAD REALIGNMENT
 - SOFTWARE OPTIMIZATION
 - SYSTEM EFFICIENCY
- PROJECTED FUTURE WORKLOAD (MANAGERIAL DECISIONS):
 - 10 PERCENT WORKLOAD GROWTH FOR 3 YEARS
 - 25 PERCENT WORKLOAD GROWTH FOR 3 YEARS
- DO NOT CONFORM WITH ADP MANAGEMENT AND PROCUREMENT CRITERIA
 - FIRMR PART 201
 - FIPS PUB 75
 - FIPS PUB 42-1
 - SPECIAL PUBLICATION 500-123

CAPACITY NEEDS - IRS PROJECTIONS

IRS' processing problems during the 1985 filing season resulted largely from its weekend batch update processing, which frequently took longer than the 48 hours available on a weekend. As a result, this processing had to be completed during the week and reduced the availability of computers for processing the daily on-line workload. To combat the problem, IRS added processors to its largest service centers and took other actions to improve its utilization of the processors.

When determining the processing power needed to handle the projected weekend processing within the available 48 hours, IRS used measures of workload and computer utilization. The key workload measure used was the number of accounts updated; the computer utilization measure was the Central Processing Unit (CPU) hours expended for the updates. Actual data for the Fresno Service Center was used to estimate the number of accounts processed and CPU hours needed for each service center since Fresno had the heaviest weekend workloads and heaviest processor utilization. The number of accounts was adjusted only for a planned 1986 realignment of workload between service centers; the CPU-hour utilization was adjusted for planned software improvements that were intended to reduce the weekend processing time.

The adjusted figures for peak weekend processing were used as the 1985 base for determining the agency's future processing needs. IRS management decided to apply a 10-percent growth rate to this base for 3 years (1986-1988) and a 25-percent growth rate for the following 3 years (1988-1991). These projected growth rates were estimates based on constraining growth until CEPS implementation in 1989 and then accommodating any user demands built up during the constrained period.

IRS has performed several ad hoc analyses of workloads to improve the efficient use of the mainframes since the 1985 filing season. However, IRS has not conducted a comprehensive analysis of its current or future workloads nor has it assessed the impact these various workloads have on the utilization of its mainframe computers. Such an analysis was not conducted in preparation for the CEPS procurement because IRS believed that it did not have time to conduct the analysis and still implement an upgraded or replacement system before the 1989 filing season.

IRS' determination of projected processing needs did not conform to the Federal Information Resources Management Regulation (FIRMR) parts 201-20 and 201-30. The FIRMR specifies that acquisition of ADP capabilities shall be preceded by a comprehensive requirements analysis. Among the considerations agencies must address in a requirements analysis are present and projected system workloads and the current ADP performance

baseline. A requirements analysis includes: (1) system life, (2) data bases and data base management, (3) data handling or transaction processing by type and volume, and (4) expandability requirements. When analyzing agency requirements, an agency should also give consideration to a performance evaluation of the currently installed ADP system(s) to provide a baseline for evaluation of proposed alternatives for meeting the data processing needs.

The National Bureau of Standards offers further workload analysis and forecasting criteria in Federal Information Processing Standards Publications 42-1 and 75. These publications provide guidance for constructing benchmarks as part of the ADP acquisition process, quantifying workload, and analyzing workload to be performed by a new system. Workload should be quantified in terms of agency functions and objectives, user performance objectives, and work volumes. One publication, Special Publication 500-123, discusses workload forecasting and describes the steps and quantitative techniques to be used in forecasting future workload requirements. It states that the workload forecasting process is an integral part of the life-cycle management of a system and that without an ongoing workload forecast, the system capacity needed to perform the workload cannot be effectively estimated and planned.

CAPACITY NEEDS-IRS' INDEPENDENT CONTRACTOR

- DATAMETRICS CONTRACT FOR CAPACITY PLANNING AND MANAGEMENT SERVICES
- ORIGINAL STATEMENT OF WORK
 - COMPUTER UTILIZATION MEASURE
 - WORKLOAD MEASURE
 - TRAINING PROGRAM
- CONTRACT FOR COMPUTER UTILIZATION MEASURE ONLY THROUGH 1989
- IRS FURNISHED CONTRACTOR WITH WORKLOAD PROJECTIONS
- CONTRACTOR CONCLUDED THAT IRS MUST ACHIEVE ITS "STRETCHING-OUT" INITIATIVES FOR IRS TO EXTEND EXISTING MAINFRAMES' USEFUL LIFE THROUGH 1989
- CONTRACTOR CAUTIONED IRS ABOUT INHERENT RISKS OF RELYING ON A SYSTEM ABOVE A 90-PERCENT UTILIZATION

CAPACITY NEEDS - IRS' INDEPENDENT CONTRACTOR

Because IRS was having difficulty defining its computer resource needs, Treasury encouraged the agency to contract with a commercial firm for computer capacity planning services. IRS contracted with Datametrics on March 5, 1986, to perform a system utilization analysis, which included a baseline capacity study, a computer sizing report, and a capacity plan.

In the original statement of work, IRS required a workload analysis and training program as well as a system utilization analysis. However, due to time and funding constraints, IRS reduced the contract requirements to just the system utilization analysis. Consequently, IRS furnished the contractor with the future workload projections to be used in the analysis rather than having the contractor perform a workload analysis to better determine future needs.

To determine IRS' utilization of its Sperry systems, the contractor arranged for extensive data collection from three IRS service centers during April 1986. The contractor selected the Austin, Atlanta, and Kansas City Service Centers since they represented large, medium, and small volume centers, respectively.

Datametrics concluded that IRS has sufficient computer capacity through 1989 for handling its weekend updates as well as for its peak daily real-time processing but only if it achieves its "stretching-out" initiatives. However, Datametrics applied the IRS-furnished 10-percent growth rate projection only through 1989 and did not mathematically calculate the effects of IRS' achieving its initiatives to determine whether the system would last beyond 1989.

Datametrics also told IRS that if CPU utilization began reaching 90 percent on a continuous basis, the agency should consider measures to increase its computer capacity. The contractor believed that allowing only 10 percent of the CPU for downtime or expansion in a production environment was highly risky.

We believe that the contractor's caution is valid. IRS' projected increased processing workloads will create consistently high computer utilization as the agency approaches the 1990s. With consistently high computer utilization, IRS will increase the risk of adversely affecting system users since there will be less opportunity available to recover lost time or downtime. IRS is aware of the risks inherent in depending on a system to consistently perform at such a high level of utilization, but the agency believes that this risk is preferable to another potential computer conversion before the Tax System Redesign is implemented. We believe that the contractor's caution, along with

the agency's awareness of the inherent risks, makes it imperative that IRS not only achieve its "stretching-out" initiatives but also further improve its Sperry mainframe utilization and file-sharing capabilities. IRS must also deliver its Tax System Redesign in time to handle at least the on-line processing workload by 1992, as is currently planned.

CAPACITY NEEDS- GAO ANALYSIS

- COMPUTER CAPACITY IS SUFFICIENT THROUGH MID-1991 IF FULLY AND EFFICIENTLY UTILIZED; OTHERWISE, CAPACITY PROBLEMS MAY OCCUR AS EARLY AS MID-1988

- ANALYSIS LIMITED BY INSUFFICIENT INFORMATION ABOUT THE WORKLOADS BEING PROCESSED ON THE SPERRY MAINFRAMES

- WEEKEND CAPACITY IS SUFFICIENT THROUGH MID-1991 IF "STRETCHING-OUT" INITIATIVES ACHIEVED; BUT ONLY THROUGH 1988 IF NOT ACHIEVED

- DAILY CAPACITY IS SUFFICIENT THROUGH 1991 IF WORKLOAD GROWTH CONSTRAINT AND WORKLOAD REALIGNMENT ARE ACHIEVED; HOWEVER, A 20 PERCENT GROWTH WOULD CAUSE RESPONSE TIME PROBLEMS IN 1989

- 8-10 PERCENT GROWTH CONSTRAINT IS BOTH CRITICAL AND DIFFICULT
 - NEW COMMUNICATION PROCESSORS

 - PLANNED NEW SYSTEMS/APPLICATIONS

 - USER SACRIFICE

CAPACITY NEEDS - GAO ANALYSIS

Our analysis shows that IRS' ability to effectively utilize its Sperry computers through at least mid-1991 is contingent upon the achievement of its "stretching-out" initiatives. Without achievement of these initiatives, IRS could experience computer capacity problems as early as mid-1988 at its large service centers even with growth constrained to a 10-percent level.

Limitations on our analysis

In conducting our analysis, we were able to gather sufficient information about current computer performance to independently measure and analyze IRS' actual utilization of its mainframe computers. However, we were unable to gather sufficient information about the workloads being processed to analyze the impacts of various workload components on system utilization. We could not determine the type, volume, or mix of user demands (workload) that were driving the system to the measured utilization.

To illustrate, while we could determine that IRS was utilizing about 59 percent of its existing mainframe capacity during its April peak daily on-line processing at the Austin Service Center, we could not determine the workload creating this level of utilization in terms of the various users' needs. That is, we could not determine what proportion of the 59-percent utilization was needed to support user functions such as handling taxpayer inquiries, adjusting delinquent account balances, and updating taxpayer accounts for payments or assessments. Therefore, we could not identify problems or improvement opportunities in system utilization from the type, volume, or mix of these various demands. The workload information missing was a detailed breakdown of computer utilization by the user function supported.

IRS also did not have comparable workload information for future or projected workloads; projections were simply gross percentage increases, e.g., 8-10 percent constrained annual growth. Without sufficient information to evaluate the potential impacts of various users' future demands on computing resources, our analysis, like the contractor's was limited by the inability to measure the impacts of these demands on future IRS mainframe utilization. Consequently, we could only assume that the overall percentage increase in workload and system utilization would have a direct and consistent relationship. That is, current workloads that use a certain percent of the CPU will use the same relative proportion of the CPU as the workload increases. We were also unable to identify potential changes in users' demands for computing resources; as a result, we could not identify potential problems or improvements in system utilization resulting from future user workload requirements.

Weekend update processing

According to IRS, the weekend processing, which was a bottleneck during the 1985 filing season, was the primary cause of the difficulties it experienced at that time. Our measurement of IRS' April 1986 utilization of the mainframe computers confirms the agency contention that the weekend is the critical processing period. The average weekend utilization in the two large service centers we reviewed was approximately 77 percent. With IRS' average utilization approaching 80 percent of the current mainframe capacity, we believe that the agency is appropriately focusing its "stretching-out" initiatives on enhancing its computer utilization for the weekend processing. Our analysis shows that with the achievement of these initiatives, the existing mainframe computers can handle the projected weekend processing workload through mid-1991.

In projecting when IRS would need to upgrade or replace its existing mainframe computers to handle the weekend workloads, we made several assumptions: (1) IRS would achieve the initiatives necessary to more efficiently utilize mainframe capacity, (2) all weekend processing workloads would increase at the same rate, (3) the entire weekend would be treated as a single batch workload, and (4) weekend workload that is not a part of the weekend update processing and that is now processed along with the updates would be shifted to less busy periods or other computer systems as the weekend update workload increases.

Our analysis of computer utilization data for weekend processing demonstrated that the critical measure of weekend update processing is the time spent updating the taxpayer account files. We applied IRS' projected annual growth rates to the number of active accounts in our April 1986 weekend computer utilization analysis. The analysis reflects service centers with a maximum Sperry mainframe configuration of two 1100/84s that will be used to process IRS' weekend update workload. As indicated above, the other weekend workloads are assumed to be off-loaded to other periods or computer systems. As illustrated in table III.1 and in figures VI.1 and VI.2, unless the "stretching-out" initiatives are achieved, the large IRS service centers will begin to experience difficulty in completing their weekend processing within the 48 hours available as early as May 1988, even with workload constrained at a 10-percent level.

Table III.1:

Projected Life of Computers Currently Processing Weekend
Workloads at the Austin and Ogden Service Centers

<u>Workload Scenarios</u>	<u>Projected Growth Rates</u>			
	<u>Austin</u>		<u>Ogden</u>	
	<u>8%</u>	<u>10%</u>	<u>8%</u>	<u>10%</u>
Weekend Processing Workload Unadjusted	11/88	5/88	4/89	9/88
Workload with Program/Software Optimization	5/91	6/90	1/92	12/90
Workload with Realignment to Obtain Balance	12/90	1/90	1/90	4/89
Workload with Both Optimization and Realignment	7/93	2/92	10/92	7/91

At the 10-percent growth rate, IRS' achievement of the program optimization and workload realignment initiatives will extend the useful life of existing mainframes through mid-1991. These initiatives appear to be achievable since (1) IRS has already successfully increased the efficiency of selected weekend programs and identified additional programs as targets for efficiency improvements (a 25-percent improvement in these programs is expected) and (2) the large service centers are processing workloads that can be more evenly balanced across all service centers.

To handle the projected workload beyond mid-1991, we believe that the achievement of the IRS initiative to reduce the size of its IDRS data base, as well as more evenly distributing the processing workloads across the data storage devices attached to the mainframe computers, will be necessary.

Daily on-line transaction processing

In conducting our analysis of IRS' on-line workload, we developed detailed mathematical models to represent computer utilization during typical peak hours of processing during April 1986. Our measurements indicated current peak period utilization for the on-line workload to be 59 percent and 50 percent in the Austin and Ogden Service Centers, respectively.

In projecting when IRS would need to upgrade or replace its existing mainframe computers for handling its daily on-line processing workload, we again made several assumptions: (1) IRS would achieve the stretching-out initiatives necessary to fully utilize their capacity; (2) the on-line transaction volume, length, and mix reflected in our sample peak periods would be considered representative of IRS' on-line workload; (3) data storage devices would be efficiently used; and 4) other daily

workloads now processed concurrently with the on-line transaction processing would ultimately be shifted to less busy periods or other computer systems as increased on-line workloads necessitate. We applied IRS' projected annual growth rates of 8 to 10 percent to the on-line transaction volumes measured in our April computer utilization analysis. We also applied a 20-percent growth rate since IRS' increase in transactions has approximated that rate since the 1985 implementation of its existing processors. As shown in table III.2, as well as figures VI.3 and VI.4, if IRS more evenly distributes the processing workload across its data storage devices and holds its workload growth rate to 10 percent, the agency will be able to handle its workloads until at least October 1991. To handle the projected workload beyond 1991, we believe that the planned workload realignment will be necessary to better balance any increased transaction volumes among the centers and to avoid bottlenecks at any one center.

Table III.2:

Projected Life of Computers Currently Processing
On-line Workloads at the Austin and Ogden Service Centers

<u>Workload Scenarios</u>	<u>Projected</u>		
	<u>Annual Growth Rates</u>		
	<u>8%</u>	<u>10%</u>	<u>20%</u>
Current On-line Processing Unadjusted			
Austin	8/91	7/90	7/88
Ogden	10/93	5/92	6/89
Current On-line Processing Adjusted for Storage Devices			
Austin	2/93	10/91	3/89
Ogden	5/95	8/93	2/90

In determining satisfactory system performance in an on-line environment, an agency should consider system response time or the average time taken to respond to a user's inquiry. The IRS standard for acceptable response time is 2 seconds for at least 90 percent of the transaction volume and no more than 4 seconds for 99 percent. As shown in figures VI.5 and VI.6 the average response time will be maintained at an acceptable level beyond 1991 with a 10 percent projected growth, but will not be acceptable if the growth approximates 20 percent. As the figures reflect, once average response times begin to degrade, they quickly reach unacceptable levels.

Constraining workload growth may be difficult to achieve

As indicated before, IRS plans to constrain workload growth by restricting new applications. We believe that this may be

difficult to achieve because of agency plans to install new communications processors, expand the terminal network, and introduce new on-line applications that will potentially increase demand for tax account information. Furthermore, variations of the current mix, volume, or type of users' transactions may alter system utilization even with growth constrained on new applications.

The new communications processors, planned for implementation in 1987, are expected to be able to process up to 60 transactions per second, while the existing processors can only process an average of about 20 transactions per second. The expansion in the number of terminals on the network will as much as double the current network size. This replacement and expansion will provide a capability for greater access to the mainframe computers. With this new capability, attempts to limit transaction growth may be difficult, even though IRS does not anticipate an increased processing workload as a result of this increased access to the mainframe computers.

Our analysis of response time relative to transactions per second, as illustrated in figures VI.7 and VI.8, indicates that the existing IRS mainframes cannot handle 60 transactions per second and maintain acceptable average response times. As the mainframe approaches 45 transactions per second, its average response time degrades to an unacceptable level. It should be noted that the 45 transactions per second equates to about 30 transactions from the communications processor since the mainframe computer generates additional internal transactions. Consequently, if the communications processor is utilized to even half of its capability (30 transactions per second), the mainframe's average response time will be adversely affected. Thus, IRS must consider the communications processor workload when attempting to constrain its workload growth.

The major new applications IRS is planning to implement include: the Automated Examination System, the Integrated Collection System, and the Automated Taxpayer Service System. Each of these new applications will require access to taxpayer account information on the existing mainframe computers. The applications will most likely affect both the daily on-line workloads and the weekend update workloads of the current mainframe computers. IRS must have a clear understanding of the potential workloads that these applications will generate because it may find that its need to limit workload growth may not be compatible with its plans to introduce these new applications.

Furthermore, the failure to anticipate a computer capacity problem may also have a devastating impact on IRS operations, as was evidenced by the 1985 filing season when, among other things, a computer capacity shortage was unexpectedly experienced and resulted in:

- millions of dollars of interest being paid on late refunds to taxpayers,
- millions of dollars in overtime payments being made to IRS employees,
- IRS' ability to answer taxpayer inquiries being impaired, and
- inaccurate notices being sent to taxpayers.

Summary

In conducting our analysis of IRS' current and future computer resource needs, we were able to gather sufficient information about current computer performance to independently measure and analyze IRS' actual usage of its mainframe computers. However, we were unable to determine the type, volume, or mix of user demands (workload) that were driving the systems being measured. Without such information, our analysis, as well as that of the IRS contractor, was limited by our inability to predict the impacts of these demands on future IRS mainframe usage. For workload data we both had to use limited summary data--e.g., total of all transactions processed and taxpayer accounts updated, regardless of the various computer programs which generated these workloads. Using this data we could only presume that the overall percentage increase in workload and system usage would have a direct and consistent relationship.

Our analysis focused on IRS' weekend update processing and daily on-line transaction processing for periods in April 1986. We confirmed IRS' belief that the weekend is its critical processing period and that its "stretching-out" initiatives are appropriately focused on this workload.

Our analysis of computer usage data for weekend processing demonstrates that unless IRS achieves its initiatives, the large service centers will not be able to complete their processing within the required time as early as May 1988. However, if IRS achieves the initiatives, the useful life of its mainframe computers will reach at least mid-1991.

We also determined that the efficiency of the mainframe computers was directly affected by the efficiency of the use of their associated disk storage devices. Accordingly, the efficient use of these devices is essential for the current mainframe computers to handle the on-line workload through late 1991.

Our analysis of the daily on-line processing workload demonstrates that IRS will be able to handle this workload until at least October 1991 if it efficiently uses its disk storage devices and holds its growth rate to 10 percent. To handle this

workload beyond October 1991, IRS must also better balance its workloads between service centers. If IRS does not make adjustments to its on-line workload and the workload increases to 20 percent (which it has approximated since the 1985 implementation of the current mainframes), then the large centers will not be able to handle the on-line workload by mid-1988.

Another factor we considered in our analysis of the on-line workload was system response time. If system response time is unacceptable to the users of a computer system, then the system is not adequately serving those users. We determined that the average response time will be maintained at an acceptable level until late 1991, assuming IRS' projected 10-percent growth rate. Response time will not be acceptable by mid-1989 if the workload growth rate approximates 20 percent.

IRS' ability to constrain its workload growth to 8-10 percent is critical to maintaining the useful life of existing mainframes until mid-1991. However, constrained workload growth may be difficult to achieve because the agency plans to introduce new communications processors, expand the terminal network, and add new on-line applications. Considering these enhanced capabilities to access tax account information, we believe that constraining growth will be difficult, even though IRS does not anticipate that an increased growth in the overall processing workload will result.

In summary, if IRS does not achieve the constrained growth and does not complete its other initiatives, the agency could experience capacity problems at its larger service centers as early as mid-1988.

USER ASSISTANCE AND COMPUTER CAPACITY MANAGEMENT OFFICE

- ESTABLISHED TO STRENGTHEN MANAGEMENT OF COMPUTER RESOURCES
- UACCMO FORECASTING RESOURCES AND EXPERTISE LIMITED;
SUPPLEMENTED BY DATAMETRICS CONTRACT AND TRAINING PLANS
- GUIDELINES PROVIDE FOR PLANNED "NATURAL WORKLOAD" DATA; BUT
COMPARABLE DATA FOR CURRENT WORKLOAD STILL NEEDED
- ADP PERFORMANCE EVALUATION STAFF PERFORMS AD HOC STUDIES
 - INSTRUMENTAL IN REACTING TO 1985 PROCESSING PROBLEMS
 - SIMILAR ROLE IN "STRETCHING-OUT" INITIATIVES
 - LIMITED USE OF ANALYTICAL MODEL TECHNIQUES
- IRS CAPACITY- MANAGEMENT COMMITMENT IMPORTANT FOR
SUSTAINED PROSPECTIVE MANAGEMENT OF ADP RESOURCES

USER ASSISTANCE AND COMPUTER CAPACITY MANAGEMENT OFFICE

IRS recognizes the need to improve management of its computer resources. In early 1986, the Assistant Commissioner (Computer Services) established the User Assistance and Computer Capacity Management Office (UACCMO), a step that indicates an IRS commitment to strengthen its management of computer resources.

IRS has advised us, however, that staffing of the office has been limited due to budgetary constraints and a lack of IRS staff with the necessary capacity management expertise. IRS contracted with Datametrics for a computer capacity study. Staff from the office is performing as the Contracting Officer's Technical Representative on the contract and should benefit from the learning experience. In addition, separate plans are being formulated to train the UACCMO forecasting staff in computer performance analytical techniques.

The forecasting staff has established guidelines for capacity planning information, which will allow them to measure the effects of planned applications on available systems' capacity. These guidelines will require users to articulate their needs in terms of "natural workload units." These units represent planned workload in measures that relate directly to the user's work environment, for example, the number and type of delinquent taxpayer accounts to be handled by the collection function during a certain period. Needs expressed in these terms will allow UACCMO to better assess the planned components of workload and their impact on available computer resources. While these guidelines should be instrumental for assessing capacity implications of new applications, comparable "natural workload units" are needed for the applications that are currently being processed.

Another part of UACCMO is the ADP Performance Evaluation Staff, commonly referred to as the computer performance evaluation staff (CPE), which was established in 1979 and has been conducting ad hoc studies of IRS' processing environment. The staff, which helped IRS through its 1985 processing problems by identifying solutions, was also involved in identifying the initiatives to further extend the Sperry system capacity. While the staff has the capability to apply computer modeling techniques, it has only utilized these techniques sporadically because of the necessity to address existent processing problems. Furthermore, key CPE employees who have been relied upon for reacting to computer capacity problems and planning ADP procurements, have been reassigned to new computer capacity responsibilities in the initial staffing of UACCMO.

We believe that the establishment of UACCMO is an important step in IRS' attempt to gain control over its existing computer resources and to plan for future resource needs. As recognized in federal information processing guidance, an analysis of both

workload and computer utilization data is necessary to determine future computer requirements and to ensure that an agency's existing computer resources are adequate. However, provision for the necessary resources, information, and techniques is essential in order to realize its intended purpose.

CONCLUSIONS AND RECOMMENDATIONS

- MAINFRAMES HAVE SUFFICIENT CAPACITY TO HANDLE PROJECTED WORKLOAD THROUGH AT LEAST MID-1991
- IRS MUST ACHIEVE ITS "STRETCHING-OUT" INITIATIVE GOALS
- CONSTRAINT OF ANNUAL WORKLOAD GROWTH IS ESSENTIAL, BUT MAY BE DIFFICULT TO ACHIEVE
- IRS COULD EXPERIENCE CAPACITY PROBLEMS AT LARGE SERVICE CENTERS BY MID-1988 UNLESS INITIATIVES ACHIEVED
- COMPREHENSIVE WORKLOAD ANALYSIS AND CONTINUOUS MEASUREMENT AND ANALYSIS OF CURRENT SYSTEM UTILIZATION NEEDED TO IMPROVE INVESTMENT DECISIONS ON CRITICAL COMPUTER RESOURCES
- THE COMMISSIONER OF THE IRS SHOULD
 - DEVELOP AND MAINTAIN COMPREHENSIVE WORKLOAD DATA
 - MONITOR PERFORMANCE OF CURRENT MAINFRAMES
 - ANALYZE IMPACT OF VARIOUS WORKLOADS ON UTILIZATION OF MAINFRAMES SO IRS CAN EFFECTIVELY ESTIMATE AND PLAN FOR FUTURE ADP RESOURCE REQUIREMENTS
 - REPORT TO SUBCOMMITTEE SIGNIFICANT DEVIATIONS OR DELAYS IN THE ACHIEVEMENT OF INITIATIVES OR ANY OTHER FACTORS THAT JEOPARDIZE IRS' ABILITY TO EXTEND USEFUL LIFE OF ITS EXISTING MAINFRAMES THROUGH 1991

CONCLUSIONS AND RECOMMENDATIONS

On the basis of available data, we believe that the existing mainframes will have the necessary processing capacity to handle IRS' tax processing workloads through at least mid-1991, assuming that no large unexpected increase in workload occurs and IRS effectively carries out its planned initiatives. However, IRS may find that its initiative to constrain annual workload growth to 8-10 percent will be difficult to achieve because it plans to install new communications processors, expand the terminal network, and introduce new on-line applications that will potentially increase demand for tax account information. If IRS does not constrain workload growth and successfully implement the other initiatives, it could experience capacity problems at its larger service centers as early as mid-1988. An IRS contractor, using slightly different analytical techniques than ours, concluded that IRS will have sufficient computer capacity through 1989 if the initiatives are achieved.

Although our analysis gives a rough approximation of computer capacity needs, a more reliable prediction is critical to computer resource investment decisions. Such a prediction could be developed if the workload processed by the mainframe computers were better delineated. However, beyond ad hoc analyses of workloads to improve the efficient use of the mainframes since the 1985 filing season, IRS has not conducted a comprehensive analysis of its current or future workloads, nor has it assessed the impact that these various workloads will have on its computer resources. At the time of the CEPS procurement proposal, the agency did not believe that there was enough time to conduct such an analysis and still upgrade or replace the system before 1989.

We believe that without this workload analysis, as well as a continuing analysis of current system utilization, IRS will not have adequate assurance that its initiatives are working. As a result, it could unexpectedly find itself short of computer capacity earlier than the end of 1991 when TSR implementation is scheduled to begin. Such an unexpected shortage could have a devastating impact on operations, as was evidenced in the 1985 tax filing season when, among other things, a computer capacity problem was unexpectedly experienced. IRS recognizes the need to perform the analyses and established an office to do so. However, work by this office has been delayed because of limited staffing with the necessary expertise.

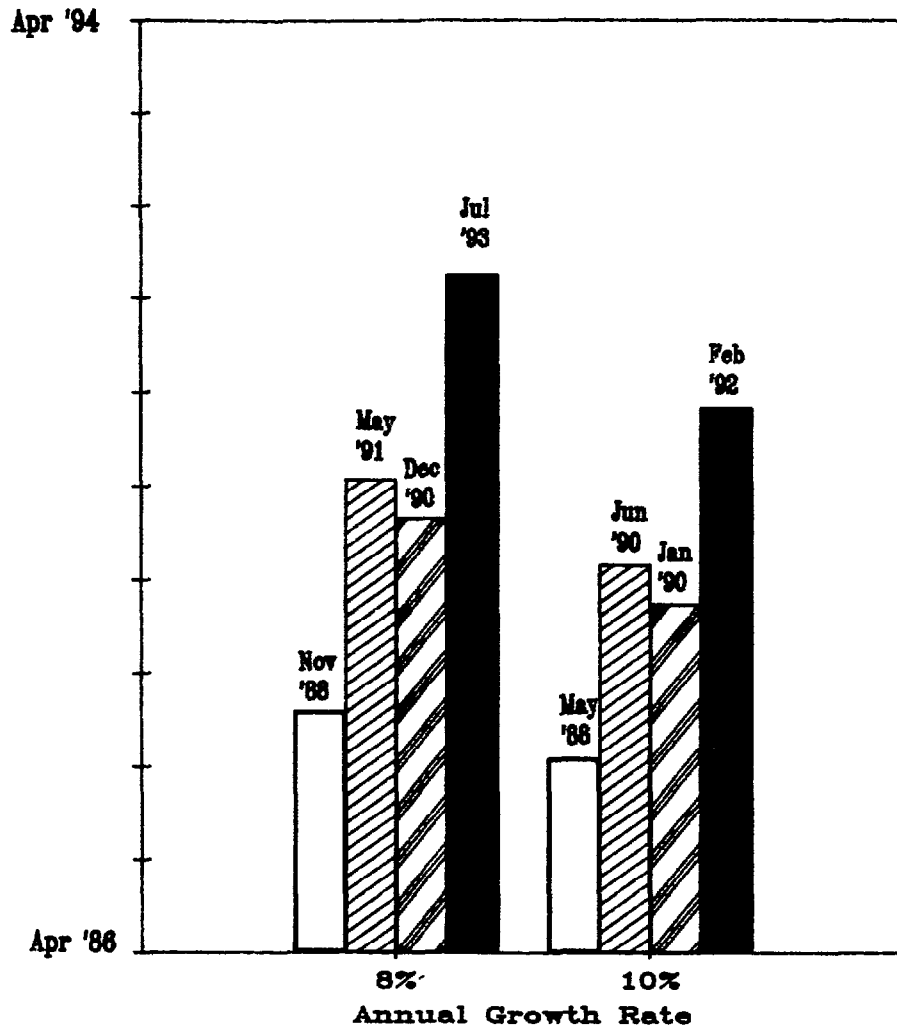
Because of the importance of the mainframe computers to IRS' ability to accomplish its mission, and with the need for continued improvement in its investment decisions on these critical computer resources, we recommend that the Commissioner of the Internal Revenue Service:

- develop and maintain comprehensive workload data for current and planned ADP requirements;
- monitor the performance of the installed mainframe computers to provide a baseline for determining whether the initiatives actually extend the useful life of the existing mainframes and for evaluating alternatives for meeting future ADP requirements;
- analyze the impact of the various workloads on the utilization of the mainframe computers to effectively estimate and plan for future IRS ADP requirements; and
- report to the Subcommittee on Oversight, House Committee on Ways and Means, any significant deviations or delays in the achievement of the initiatives or any other factors that may jeopardize IRS' ability to extend the useful life of its mainframes through 1991.

The first three recommendations are consistent with a recommendation made in our October 14, 1986 report on IRS' communications processors, regarding updating workload projections and monitoring system performance. We believe that the recommendations in both reports must be effectively implemented to ensure that IRS' initiatives extend the useful life of its mainframes and that future acquisitions of computer resources will satisfy IRS' processing needs. However, such implementation is only one of a series of critical steps that IRS must take to ensure that future acquisitions, particularly the Tax System Redesign, are effectively planned and actually satisfy IRS' ADP requirements.

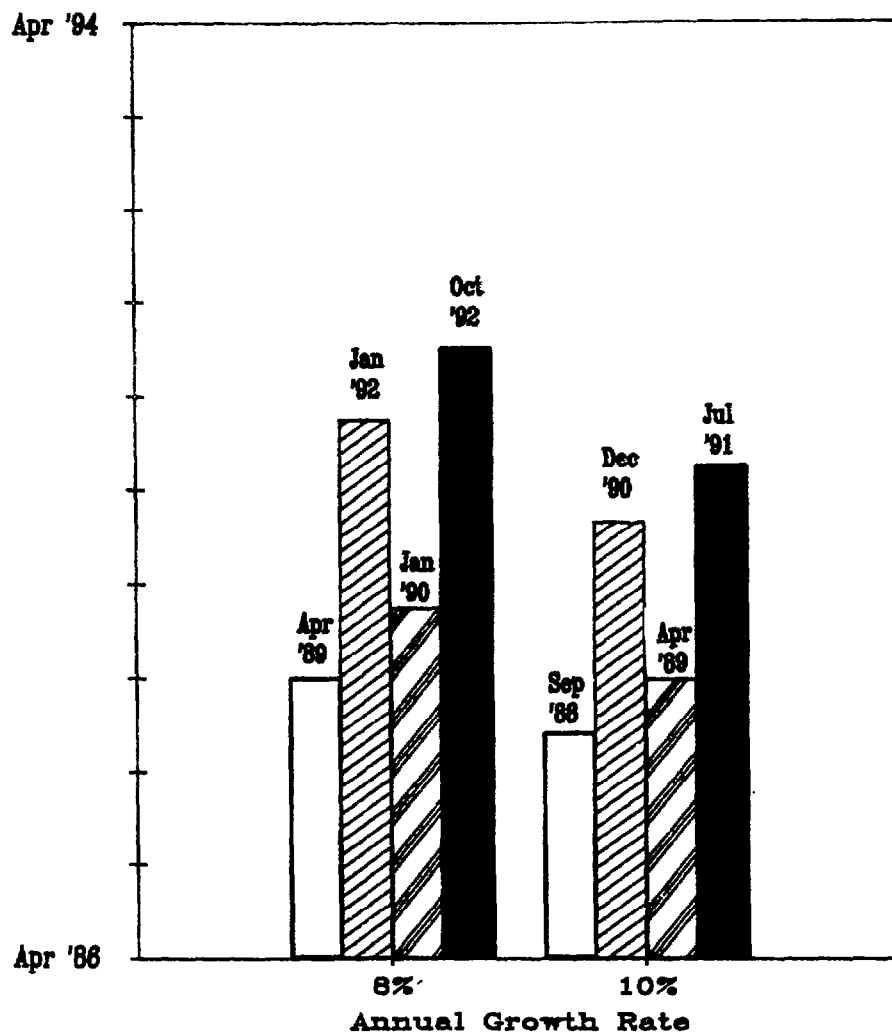
FIGURES

Figure VI.1: Projected Life of Weekend Processing Capacity – Austin



- With No Initiatives
- With Only Programming Initiatives
- With Only Workload Initiatives
- With Both

Figure VI.2: Projected Life of Weekend Processing Capacity – Ogden







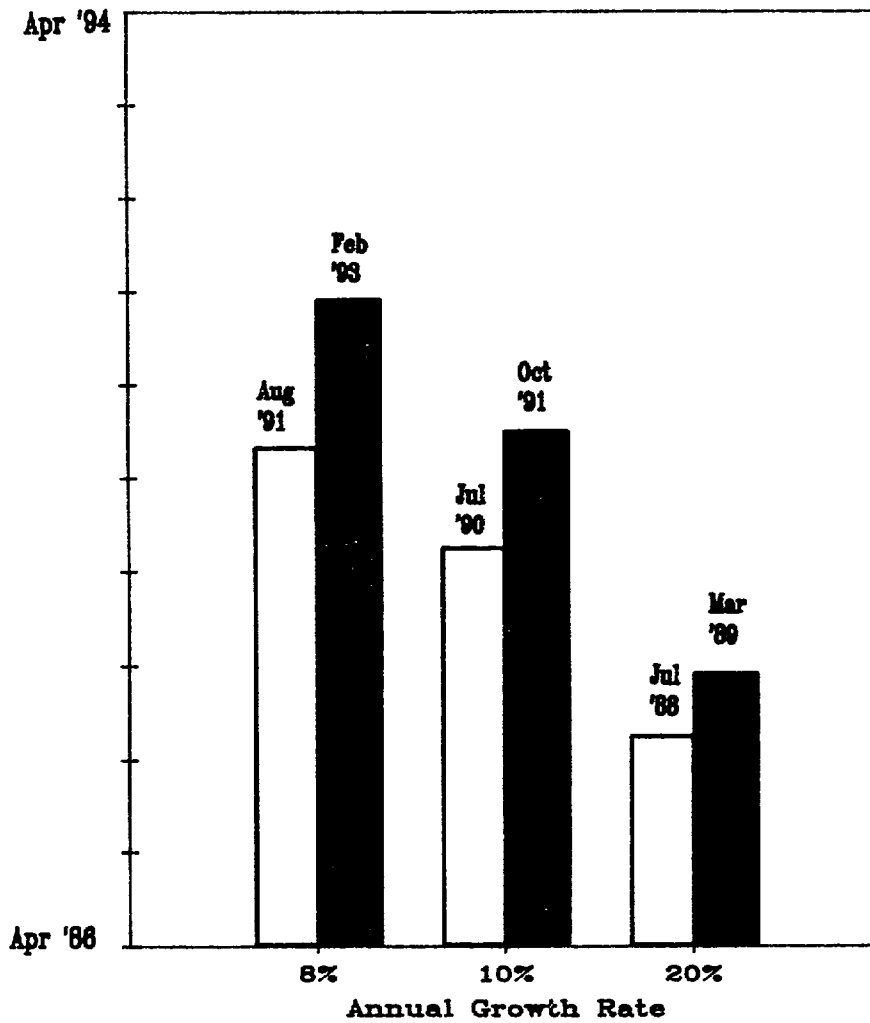
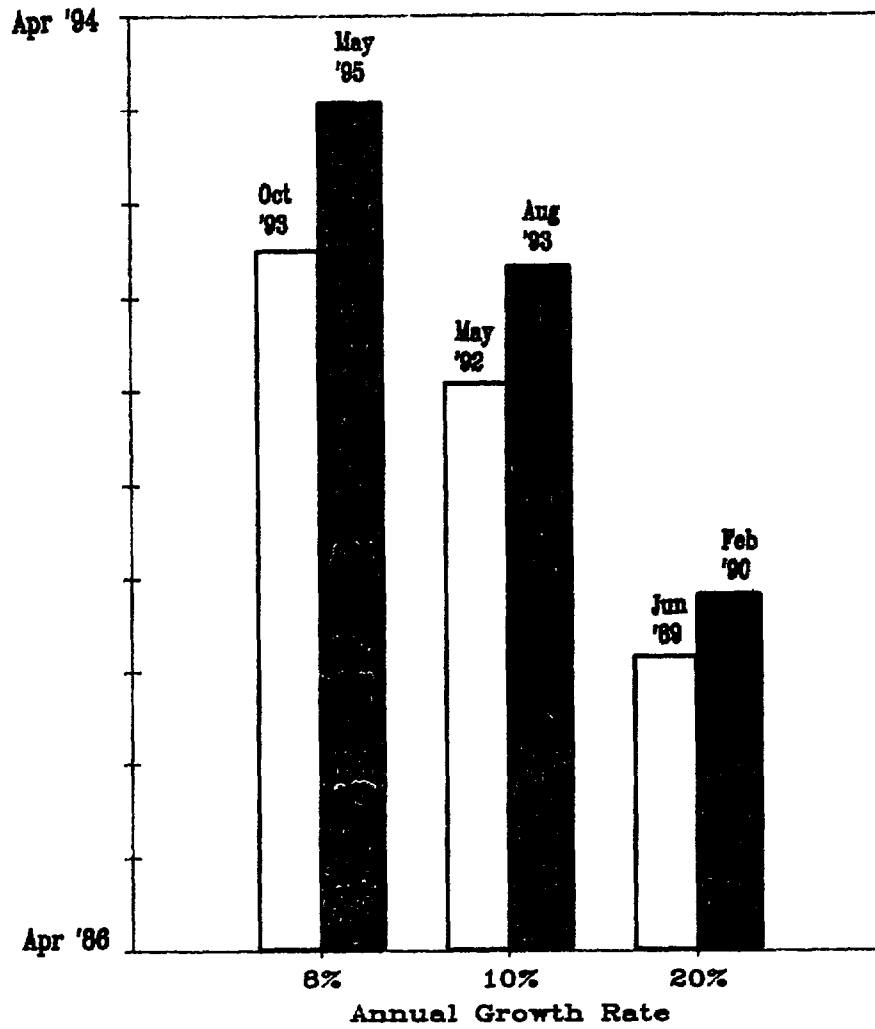
-  With No Initiatives
-  With Only Programming Initiatives
-  With Only Workload Initiatives
-  With Both

Figure VI.3: Projected Life of Transaction Processing Capacity – Austin



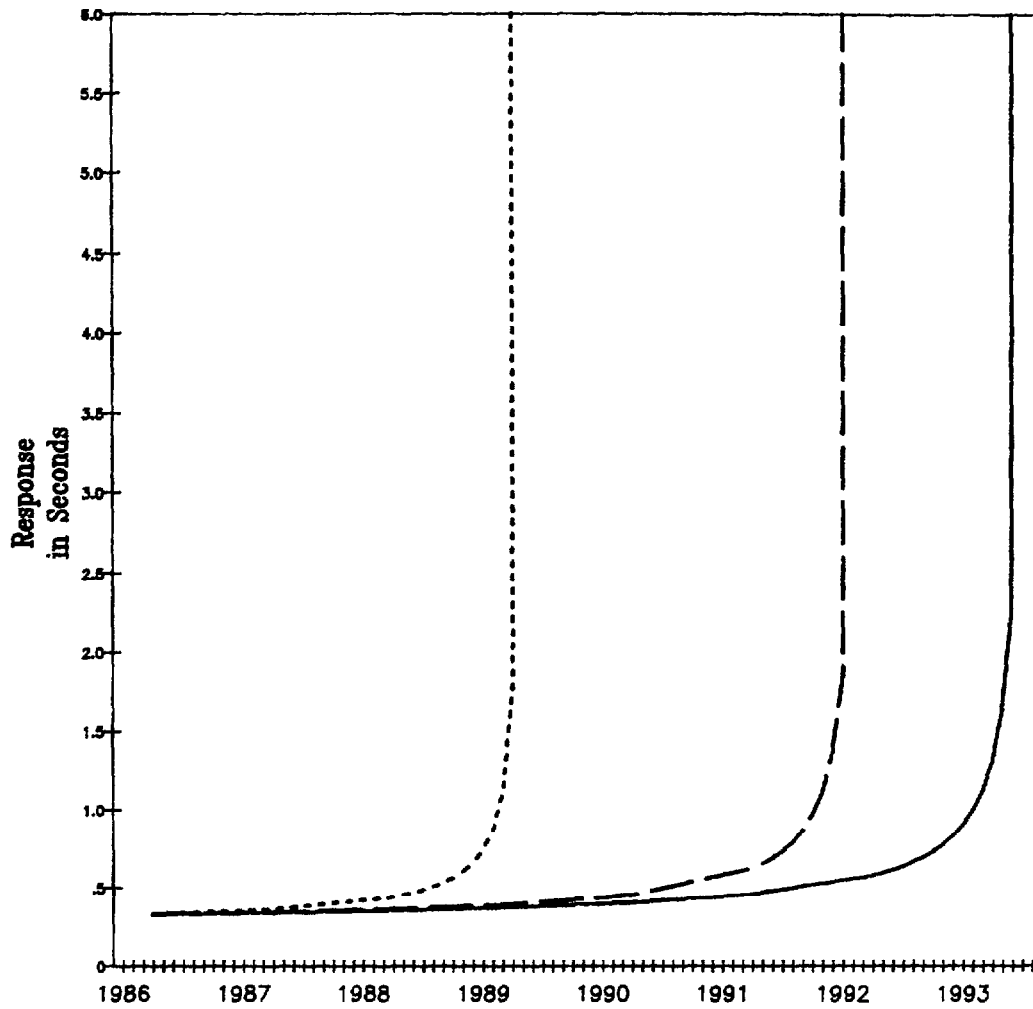
□ With No System Changes
■ With File Optimization

Figure VI.4: Projected Life of Transaction Processing Capacity - Ogden



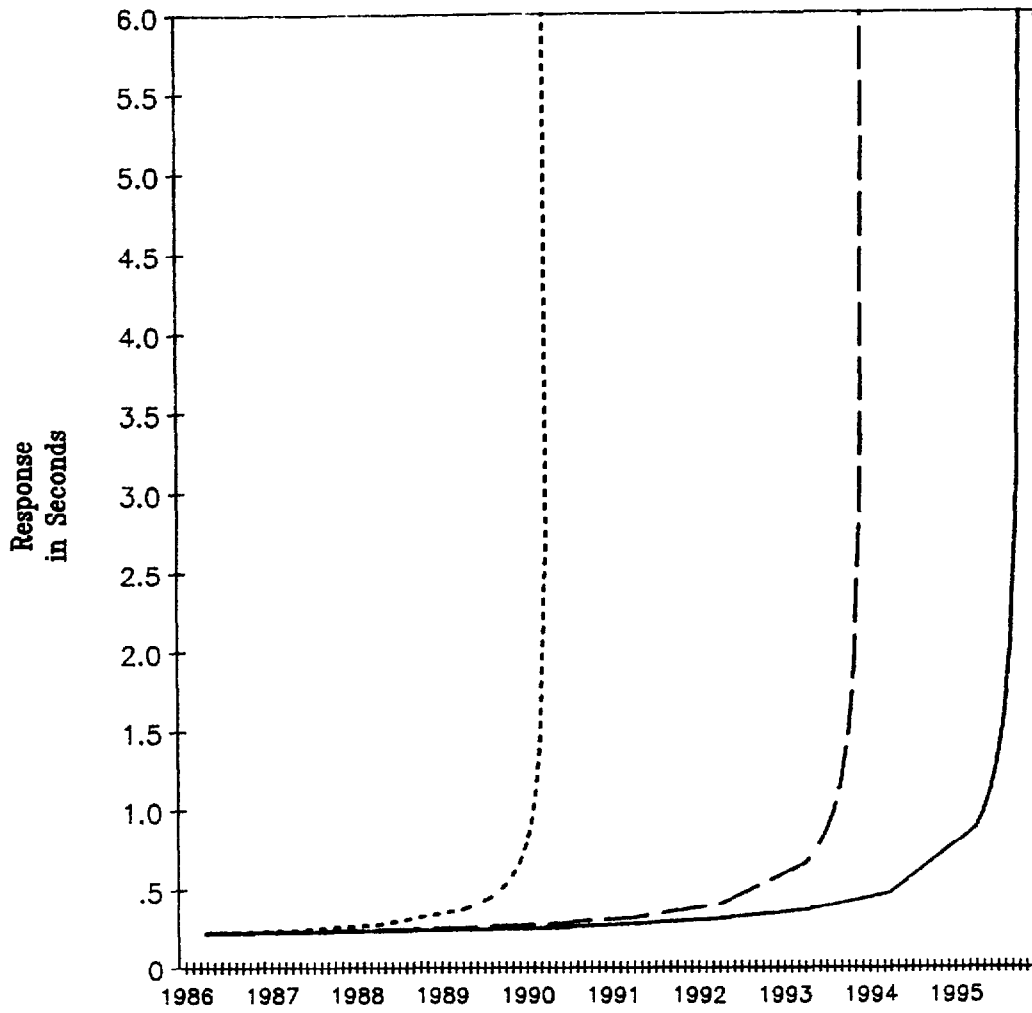
With No System Changes
 With File Optimization

Figure VI.5: Transaction Response Time After File Optimization - Austin



- 8% Annual Growth
- - - 10% Annual Growth
- 20% Annual Growth

Figure VI.6: Transaction Response Time After File Optimization - Ogden



- 8% Annual Growth
- - - 10% Annual Growth
- 20% Annual Growth

**Figure VI.7: Arrival Rate vs. Response Time
After File Optimization - Austin**

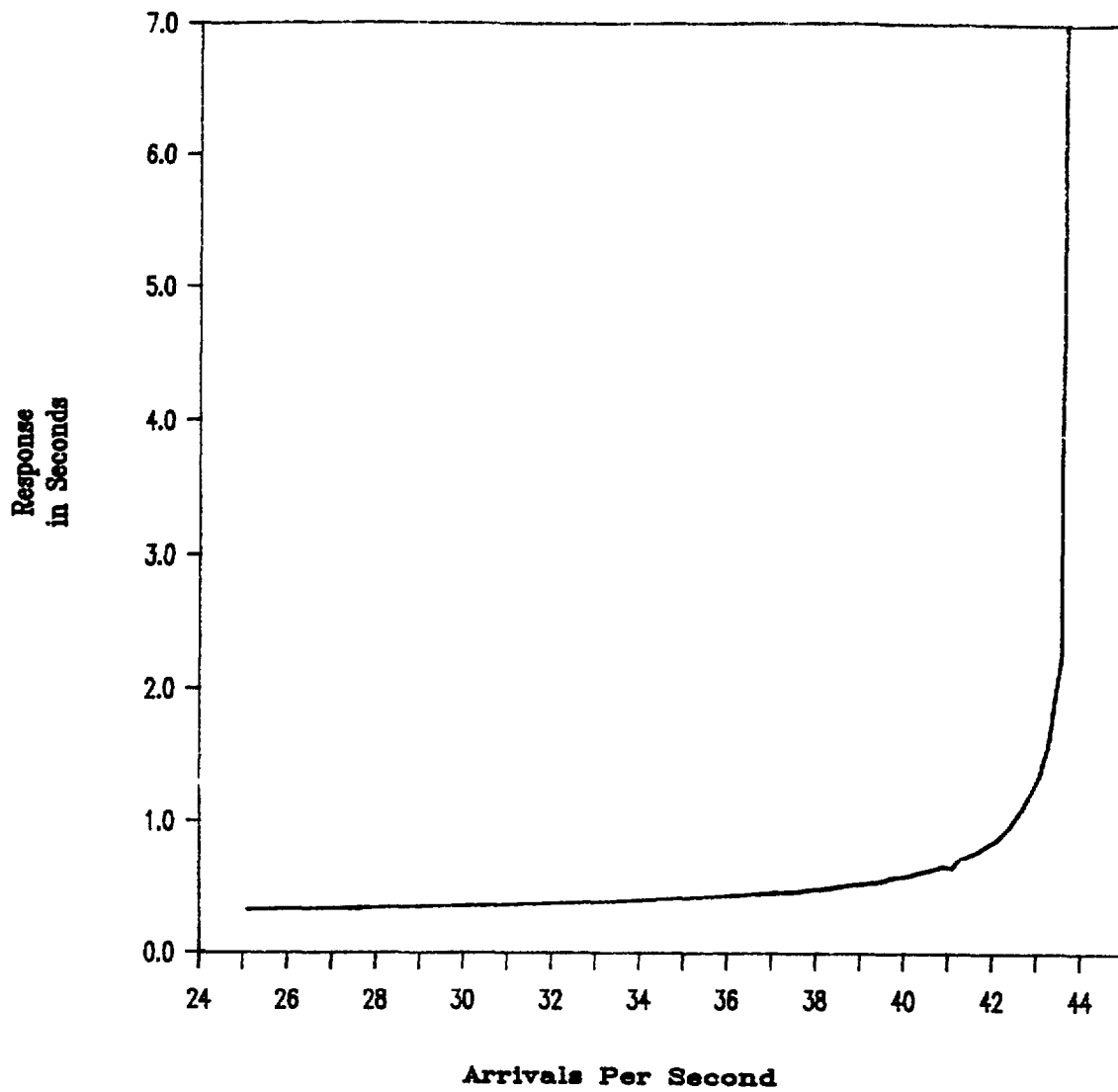
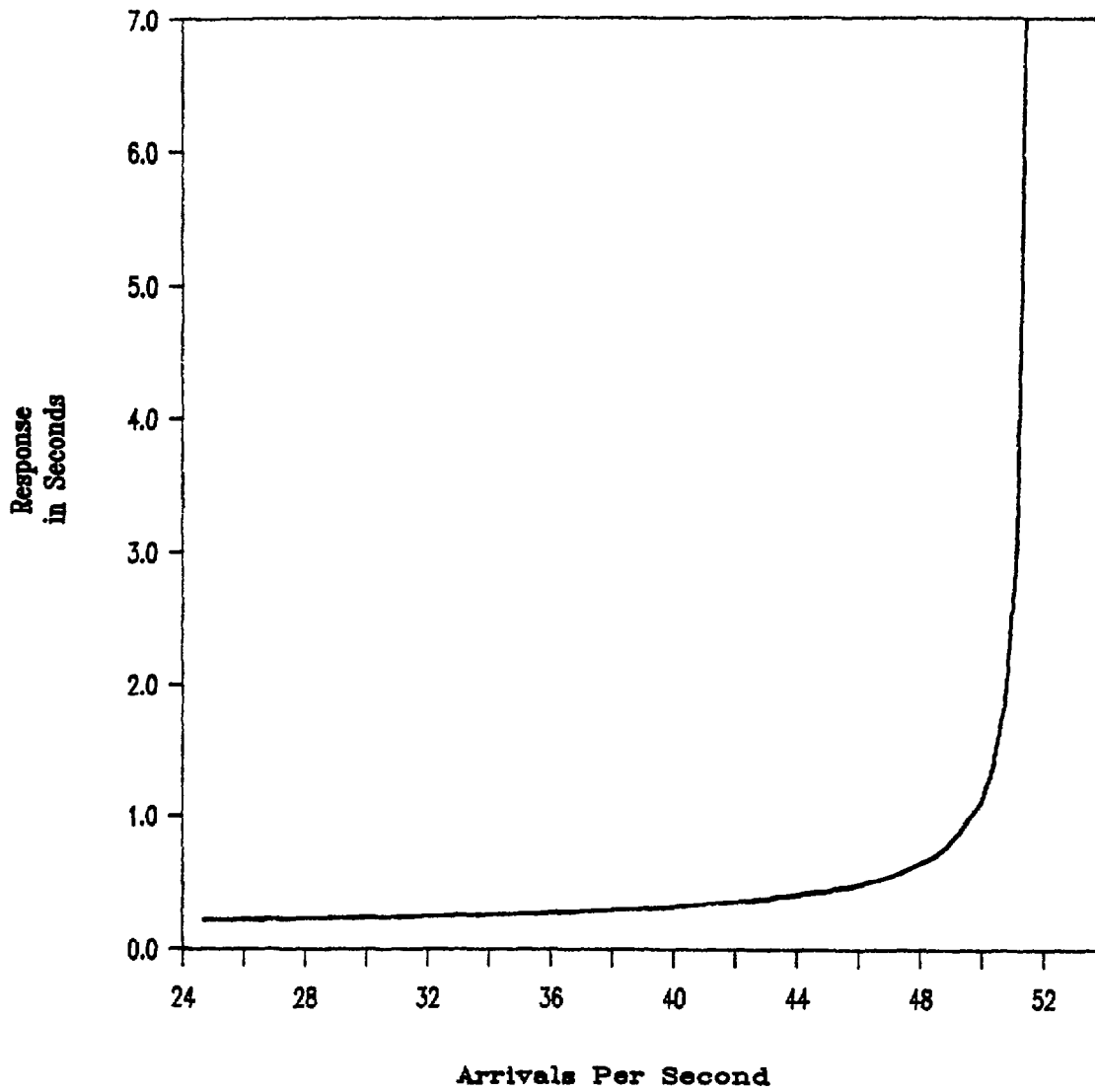


Figure VI.8: Arrival Rate vs. Response Time
After File Optimization - Ogden



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