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TAX SYSTEMS MODERNIZATION

Management and Technical Weaknesses Must Be Corrected If Modernization Is To Succeed





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

**Accounting and Information
Management Division**

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July 26, 1995

The Honorable Margaret Milner Richardson
Commissioner
Internal Revenue Service

Dear Ms. Richardson:

This report critiques the effectiveness of the Internal Revenue Service's (IRS) efforts to modernize tax processing. The report, which reflects our briefing to you in April 1995, discusses IRS's progress to implement its modernization and describes serious remaining management and technical weaknesses that must be corrected if tax systems modernization is to succeed. It makes over a dozen specific recommendations to you for improving IRS's business management and information systems management and development capabilities.

The head of a federal agency is required by 31 U.S.C. 720 to submit a written statement on actions taken on these recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Reform and Oversight not later than 60 days after the date of this report. A written statement must also be sent to the House and Senate Committee on Appropriations with the agency's first request for appropriations made more than 60 days after the date of this report.

We are sending copies of this report to the Chairmen and the Ranking Minority Members of (1) the Subcommittee on Treasury, Postal Service and General Government, Senate and House Appropriations Committee, (2) the Senate and House Committee on the Budget, (3) the Subcommittee on Oversight, House Committee on Ways and Means, (4) the Subcommittee on Taxation and IRS Oversight, Senate Committee on Finance, (5) the Senate Committee on Governmental Affairs, and (6) the House Committee on Government Reform and Oversight. We are also sending copies to the Secretary of the Treasury and the Director of the Office of Management and Budget, and will make copies available to others upon request.

This work was performed under the direction of Dr. Rona B. Stillman, Chief Scientist for Computers and Communications, who can be reached at (202) 512-6412.

Sincerely yours,

A handwritten signature in black ink, reading "Gene L. Dodaro". The signature is written in a cursive, flowing style.

Gene L. Dodaro
Assistant Comptroller General

Executive Summary

Since 1986, the Internal Revenue Service (IRS) has invested \$2.5 billion in Tax Systems Modernization (TSM). In addition, it requested another \$1.1 billion for fiscal year 1996 for this effort and, through 2001, expects to spend over \$8 billion on TSM. By any measure, this is a world-class information systems development effort, much larger than most other organizations will ever undertake. TSM is the centerpiece of IRS's vision of virtually paperless tax processing to optimize operations and serve taxpayers better.

Over the past decade, GAO has issued several reports and testified before congressional committees on IRS's costs and difficulties in modernizing its information systems. As a critical information systems project that is vulnerable to schedule delays, cost over-runs, and failure to meet mission goals, in February 1995, TSM was added to GAO's list of high-risk areas.

Purpose

To identify needed improvements in IRS's TSM effort, GAO examined business and technical practices that IRS has established to develop, manage, and operate its information systems. These practices involve IRS's business strategy to reduce reliance on paper, strategic information management practices, software development capabilities, technical infrastructures, and organizational controls. Assurance that IRS has sound practices in these areas increases the likelihood that TSM's objectives will be met cost-effectively and expeditiously.

Background

One of IRS's most pressing problems is efficiently and effectively processing the over 200 million tax returns it receives annually; handling about 1 billion information documents, such as W2s and 1099s; and, when needed, retrieving tax returns from the over 1.2 billion tax returns in storage. IRS's labor-intensive tax return processing, which uses concepts instituted in the late 1950s, intensifies the need to meet this enormous information processing demand by reengineering processes and using modern technology effectively. TSM is key to IRS's vision of a virtually paper-free work environment where taxpayer account updates are rapid and taxpayer information is readily available to IRS employees to respond to taxpayer inquiries.

In May 1994, GAO prepared a guide to the best practices used by successful private and public sector organizations to improve mission performance through strategic information management and technology. Additionally, the Software Engineering Institute at Carnegie Mellon University has

developed a model, the Capability Maturity Model (CMM), to evaluate an organization's software development capability. Also, IRS has adopted a widely used systems development methodology, known as Information Engineering, as a primary basis for developing TSM systems. GAO's strategic information management best practices, CMM's key software development process criteria, and the Information Engineering methodology were collectively used to assess IRS's tax system processing modernization efforts.

Results in Brief

IRS recognizes the criticality to future efficient and effective operations of attaining its vision of modernized tax processing, and has worked for almost a decade, with substantial investment, to reach this goal. In doing so, IRS has progressed in many actions that were initiated to improve management of information systems; enhance its software development capability; and better define, perform, and manage TSM's technical activities.

Nevertheless, the government's investment of what could be more than \$8 billion and IRS's efforts to modernize tax processing are at serious risk due to remaining pervasive management and technical weaknesses that impede modernization efforts. In this regard, IRS does not have a comprehensive business strategy to cost-effectively reduce paper submissions, and it has not yet fully developed and put in place the requisite management, software development, and technical infrastructures necessary to successfully implement an ambitious world-class modernization effort like TSM. Many management and technical issues are unresolved, and promptly addressing them is crucial to mitigate risks and better position IRS to achieve a successful information systems modernization.

First, IRS's business strategy will not maximize electronic filings because it primarily targets taxpayers who use a third party to prepare and/or transmit simple returns, are willing to pay a fee to file their returns electronically, and are expecting refunds. Focusing on this limited taxpaying population overlooks most taxpayers, including those who prepare their own tax returns using personal computers, have more complicated returns, owe tax balances, and/or are not willing to pay a fee to a third party to file a return electronically. Without a strategy that also targets these taxpayers, IRS will not meet its electronic filing goals or realize its paperless tax processing vision. In addition, if, in the future,

taxpayers file more paper returns than IRS expects, added stress will be placed on IRS's paper-based systems.

Next, IRS does not have the full range of management and technical foundations in place to realize TSM objectives. To its credit, IRS has (1) developed several types of plans to carry out its current and future operations, (2) drafted criteria to review TSM projects, (3) assessed its software development capability and initiated projects to improve its ability to effectively develop software, and (4) started to develop an integrated systems architecture¹ and made progress in defining its security requirements and identifying current systems' data weaknesses. However, despite activities such as these, pervasive weaknesses remain to be addressed:

- IRS's strategic information management practices are not fully in place to guide systems modernization. For example, (1) strategic planning is neither complete nor consistent, (2) information systems are not managed as investments, (3) cost and benefit analyses are inadequate, and (4) reengineering efforts are not tied to systems development projects.
- IRS's software development capability is immature and is weak in key process areas. For instance, (1) a disciplined process to manage system requirements is not applied to TSM systems, (2) a software tool for planning and tracking development projects is inconsistently used, (3) software quality assurance functions are not well-defined or consistently implemented, (4) systems and acceptance testing are neither well-defined nor required, and (5) software configuration management² is incomplete.
- IRS's systems architectures (including its security architecture and data architecture), integration planning, and system testing and test planning are incomplete. For example, (1) effective systems configuration management practices are not established, (2) integration plans are not developed and systems testing is uncoordinated, and (3) standard software interfaces are not defined.

Finally, IRS had not established an effective organizational structure to consistently manage and control systems modernization organizationwide. The accountability and responsibility for IRS's systems development was spread among IRS's Modernization Executive, Chief Information Officer,

¹A system architecture is an evolving description of an approach to achieving a desired mission. It describes (1) all functional activities to be performed to achieve the desired mission, (2) the system elements needed to perform the functions, (3) the designation of performance levels of those system elements, and (4) the technologies, interfaces, and location of functions.

²Configuration management involves selecting project baseline items (e.g., specifications), systematically controlling these items and changes to them, and recording their status and changes.

and research and development division. To help address this concern, in May 1995, the Modernization Executive was named Associate Commissioner. The Associate Commissioner will manage and control modernization efforts previously conducted by the Modernization Executive and the Chief Information Officer. The research and development division will not, however, report to the Associate Commissioner.

Principal Findings

Business Strategy Will Not Maximize Electronic Filing

IRS will not achieve the full benefits that electronic filing can provide because it does not have a comprehensive business strategy to reach its electronic filing goals or its vision of virtually paperless tax processing. IRS's goal is to have electronic filings for 70 million individual returns and 10 million business returns by 2001. This goal of 80 million electronically filed returns represents 35 percent of all returns. On the basis of the current rate of electronic filings from individuals, IRS estimates that by 2001, only about 29 million individuals will file electronically. If 10 million business returns are filed electronically as projected, a total of about 39 million filings will be electronic. This is only about 17.4 percent of the 224 million tax returns anticipated in 2001, less than half of IRS's goal.

IRS's electronic filing strategy focuses primarily on promoting faster refunds to those taxpayers who use third parties to prepare and transmit their simple tax returns and are willing to pay to file their returns electronically. IRS has no comprehensive business strategy to encourage other taxpayers to file electronically, including, for example, taxpayers who (1) are unwilling to pay preparers and transmitters to file electronically, (2) prepare their own returns, (3) owe IRS for balances due, and (4) file complex tax returns. Also not targeted are taxpayers who use personal computers to prepare their tax returns. These taxpayers prepare their returns electronically, print the returns on paper, and mail the paper to IRS. IRS then expends effort to convert information on the paper return back to electronic form.

Further, failure to meet or exceed electronic filing goals could seriously impair IRS's future ability to efficiently process paper tax returns. For example, IRS is developing the Document Processing System to electronically capture all data from paper returns in five submission

processing centers. IRS is proceeding on the assumption that at least 61 million of the 224 million returns estimated for 2001 will be filed electronically, which will leave 163 million paper returns. However, since only 39 million returns may be filed electronically by 2001, these processing centers and the Document Processing System could be required to handle 185 million paper returns, or 22 million more than is currently planned.

Without a strategy to maximize electronic filings, IRS, for the foreseeable future, will continue to be inundated with paper filings that must be processed using labor-intensive processes and inefficient systems. Unless IRS revamps its approach, multi-billions of dollars will be spent and the Service will still fall far short of its paperless tax processing goal.

Strategic Information Management Practices Are Not Effectively Used

IRS does not have an effective process for selecting, prioritizing, controlling, and evaluating the progress and performance of major information systems investments. IRS has actions underway to improve its strategic information management practices, but many shortcomings underscore the urgency of bolstering its use of the best practices private and public sector organizations use in developing ambitious and successful systems modernization efforts.

For example, IRS has developed several types of plans, such as the IRS Future Concept of Operations, to carry out its current and future operations. However, while critical parts of this plan have been completed, it does not yet cover essential areas, including those related to national and regional offices, workload distribution management, area distribution centers, and process flows. Further, the planning documents are not linked to each other, and there is not a strong tie between TSM plans and IRS budgets. The absence of complete and consistent strategic planning makes it difficult for IRS to identify and effectively focus on completing priority TSM projects.

IRS has also developed draft criteria, including factors such as cost, project size, and mission benefit, to review TSM projects, but these factors are not fully defined. For example, there are no criteria by which to quantitatively assess a project's contribution to achieving the business mission, or to measure its technical risk and compare that to its cost and expected mission benefits. Consequently, the draft review criteria do not provide a basis for controlling and evaluating TSM information systems as

investments throughout their life cycles.³ With this discipline, IRS could identify early, and thus avoid investing resources in, high-risk projects that have little potential to provide significant mission benefits.

In addition, IRS has a process reengineering conceptual model, has identified six core business areas, and is reengineering 3 of the 11 business processes that support these areas. However, IRS started business process reengineering efforts after many automated systems design and development efforts were already underway. As a result, IRS's business process analysis is not driving TSM development and, thus, there is no assurance that TSM will achieve the desired objectives or support the improved business processes.

Further, IRS has done a cost and benefits analysis for TSM but this analysis is flawed because it is based on outdated data and it attributes some benefits to TSM that are actually attributable to other initiatives and projects. As a result, the cost and benefits analysis is unreliable and leaves IRS and the Congress without an effective tool to know what investments in TSM are worthwhile.

Finally, IRS is currently assessing its skill and competency base, but it does not have a completed process to upgrade skills or to provide the training necessary to operate and maintain sophisticated systems, such as those comprising TSM. More important, however, because IRS has not yet completely identified the skills it will need in the future, it cannot determine its current skills gap or develop requisite training.

Software Development Process Is Weak

In August 1993, using CMM, IRS rated its software development capability as immature, the lowest level. This level of maturity—CMM level 1—is described as ad hoc and, at times, chaotic, and indicates significant weaknesses in software development capability. Since that date, IRS's software development capability has not improved significantly. IRS's software development activities remain inconsistent and poorly controlled, with no detailed procedures for systems engineers to follow in developing software.

As a result, IRS faces a much greater exposure to extensive rework, schedule slippage, and cost overruns in developing software. To effectively develop software in-house, IRS must raise its in-house software

³Life cycle is a term used to refer to the phases of a system's evolution from beginning to end (i.e., from perceived need for a system extending through systems design, implementation, operations, and maintenance).

development maturity level. To oversee its contractors effectively, IRS contract managers must understand the practices used to develop software at CMM level 2.

To address software development weaknesses in key process areas, IRS initiated several process action teams, which have made varying progress. For instance, these teams have (1) studied and flow charted the process for requesting information services, (2) adopted a peer review process to assess software quality that is being applied to selected projects, (3) selected a software tool for planning and tracking the progress of software development projects, and (4) issued guidance on unit testing.

Nonetheless, IRS's software development capability remains weak in key process areas and the teams' actions have not yet significantly improved IRS's software development capability. For example,

- configuration management is incomplete, which means important documentation to record and report the status and changes to systems specifications is not tightly controlled;
- a requirements management process, which defines, validates, and prioritizes requirements, such as performance requirements and delivery dates, is applied to only existing IRS systems, to the exclusion of TSM systems; and
- detailed procedures have not been defined for performing software quality assurance functions, such as ensuring compliance of software products and processes with defined standards and independently verifying product quality.

Unless IRS makes substantial improvements in areas such as these, it is unlikely to build TSM timely or economically and TSM is unlikely to perform as intended. For instance, IRS could enhance software quality assurance by using software metrics, which are numerical measures presumed to predict an aspect of software quality, such as the numbers of defects at various stages of software development and the costs to repair defects.

GAO found, however, that IRS has not adequately defined a suite of metrics. IRS's use of metrics is limited to only one type of metric, collectively called function points, which is used to measure a project's size, such as lines of code. IRS, however, is not consistently or effectively applying even this limited metric to software development projects throughout their life cycles.

Systems Architectures, Testing, and Integration Are Not Adequately Addressed

IRS has not adequately managed TSM technically. For example, while systems architectures are necessary to provide detailed guidance to systems designers and developers, the TSM integrated system architecture, or blueprint, is being completed as modernization progresses, and it is not driving TSM projects that are already underway. Also, IRS has made progress in defining its security requirements, issued an information security policy, and defined preliminary security applications program interfaces, but it has not completed security architecture in key areas, such as a security concept of operations, disaster recovery and contingency plan, and communications security plan. Further, IRS has analyzed its current systems to identify data weaknesses, but its data architecture is based on these existing processes, rather than on the improved business processes that IRS is now developing.

In other technical areas, IRS

- Has established a Configuration Control Board to consistently manage and control all system changes, but the Board has focused only on monitoring individual project costs and schedules. Moreover, IRS has not established a process to manage systems changes, which is necessary, for instance, to make engineering and trade-off decisions, maintain up-to-date systems descriptions, and track every system component.
- Has no comprehensive integration strategy or programwide integration plan that describes an approach and methodology to integrate current and future initiatives into the TSM systems architecture. IRS also performs systems testing in operational environments, including its service centers or computer centers, rather than in a controlled environment dedicated to thorough testing. Although IRS recognizes the need for strong systems integration and systems acceptance testing and is taking steps to improve each of these areas, it has not yet completed the requisite plans or established an integrated testing facility.
- Has an effort underway to define and document standard application program interfaces with TSM. These interfaces define how applications software can access and use standard functions. However, IRS is proceeding with TSM systems development projects before this effort is complete. As a result, these systems will require evaluations to determine what rework is needed to ensure that their conformance with the standard interfaces IRS is developing.

IRS recognizes the need to better define, oversee, and manage TSM development in fundamental technical areas. However, until it institutes stronger and more disciplined technical management, IRS risks developing

systems that do not satisfy mission objectives and that require significant and costly redesign or replacement.

TSM Accountability and Authority Were Fragmented

TSM is not a one-time, turnkey replacement of all current subsystems; it is a target system IRS plans to reach by incrementally upgrading or replacing operational systems over several years. Accordingly, it is important that IRS maintain an organizationwide focus to manage and control all new modernization systems and all upgrades and replacements of operational systems.

However, no organizational structure existed below the Commissioner's office with the accountability and authority needed to manage the tax systems modernization. Historically, accountability and authority for systems development and operation were fragmented among IRS's Modernization Executive, Chief Information Officer, and research and development division. In May 1995, the Modernization Executive was named Associate Commissioner and given responsibility to manage and control modernization efforts previously conducted by the Modernization Executive and the Chief Information Officer. However, the research and development division does not report to the Associate Commissioner.

Recommendations

In a briefing to the IRS Commissioner on April 28, 1995, GAO made several recommendations aimed at overcoming the management and technical weaknesses impeding successful modernization efforts. In this regard, GAO recommends that IRS's electronic filing business strategy focus on a wider population of taxpayers, including all taxpayers who can file electronically most cost beneficially.

In addition, GAO recommends improvements to IRS's strategic information management, software development capability, and technical activities. First, GAO recommends that the Commissioner take immediate action to improve IRS's strategic information management by implementing a process for selecting, prioritizing, controlling, and evaluating the progress and performance of all major information systems investments, both new and ongoing, including explicit decision criteria. Using the best available information, IRS needs to develop quantifiable decision criteria that consider such factors as cost, mission benefits, and technical risk. By June 30, 1995, IRS should review all planned and ongoing systems for fiscal year 1996 using these criteria. Through this review, IRS will provide the Congress with insight, based on consistently applied and well-defined

factors, upon which to gauge IRS's priorities and rationalization for TSM projects.

Next, GAO recommends that the Commissioner (1) immediately require IRS's future software development contractors to have CMM level 2 maturity and (2) by December 31, 1995, take measures that will improve IRS's software development capability. The specific measures recommended are intended to move IRS to CMM level 2 and include implementing consistent procedures for software requirements management, quality assurance, configuration management, and project planning and tracking.

Finally, GAO recommends that the Commissioner take several actions by December 31, 1995, to improve key system development technical activities. These specific actions include (1) completing an integrated systems architecture and security and data architectures, (2) institutionalizing formal configuration management for all new systems development projects and upgrades and developing a plan to bring ongoing projects under formal configuration management, and (3) developing security concept of operations, disaster recovery, and contingency plans.

GAO also recommends that the IRS Commissioner assign the Associate Commissioner responsibility for managing and controlling all systems development activities, including the research and development division's systems development efforts.

The time frames that GAO is recommending coincide with congressional deliberations on IRS's fiscal year 1996 and the fiscal year 1997 budget cycle. Meeting these time frames is necessary to provide the Congress a sound basis for funding investments in system modernization projects, overseeing TSM's progress in achieving mission improvements, and analyzing TSM costs and benefits.

Agency Comments and Our Evaluation

In June 21, 1995, comments on a draft of this report, IRS agreed with GAO's recommendations for improving TSM in areas such as electronic filing, strategic information management, software development, technical infrastructure, and accountability and responsibility. Further, IRS said that steps have already been started to implement several of GAO's recommendations, including (1) convening an electronic filing strategy group to develop a comprehensive strategy that will broaden public access

to electronic filing and (2) conducting a critical program review to rescope IRS program objectives, set priorities, and adjust funding levels for TSM.

IRS also said that a detailed action plan was being developed to implement all of GAO's recommendations, and IRS will make every effort, within available resources, to implement them by December 1995. In addition, IRS said that it recently completed a self-assessment of its practices compared to GAO's best practices for strategic information management. According to IRS, its self-assessment confirmed GAO's findings and will help strengthen IRS's overall response to GAO's concerns.

GAO believes that the steps IRS has outlined will help to move toward ensuring that the TSM effort is better focused to meet IRS's mission needs.

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Abbreviations

CMM	Capability Maturity Model
GAO	General Accounting Office
IRS	Internal Revenue Service
TSM	Tax Systems Modernization

Introduction

The receipt, processing, and retrieval of vast quantities of paper forms and documents is one of IRS's most critical problems. IRS annually receives

- over 200 million tax returns with multiple attachments,
- about 1 billion information documents (for example, W2s and 1099s), and
- several hundred million pieces of taxpayer correspondence.

To process this enormous volume of paperwork, IRS uses labor-intensive processes and systems to (1) convert data from tax returns into machine usable form, (2) maintain taxpayer accounts, including current and historical data, (3) ensure refunds are prompt, and (4) prepare bills for tax payments due. Retrieving paper forms and documents involves over 1.2 billion tax returns stored in over 1 million square feet of space.

Also, IRS collects most of the government's revenue, currently over \$1.25 trillion annually, and it employs over 113,000 people, more than any other civilian agency. IRS is headquartered in Washington, D.C., and has 7 regional offices, 63 district offices, 10 service centers, and 2 computer centers.

Background

Processing Tax Return Information

Upon receipt at IRS's service centers, paper-based tax returns and related supporting and information documents are manually extracted from envelopes, sorted, batched, coded, and transcribed¹ into electronic format. The service centers send electronically formatted data to IRS's main computer center in Martinsburg, West Virginia. IRS stores nearly all the paper supplied by taxpayers as part of, or in support of, their tax filings.

Tax return processing at IRS service centers was designed in the late 1950s. Today, nearly 4 decades later, IRS still processes tax return data using the processes instituted when automated systems were first installed in the service centers.

In today's technological climate, taxpayers have come to expect faster, better, more convenient service in virtually every facet of their lives. To meet these expectations, IRS's outdated tax processes and systems are being used to electronically capture and provide more and more

¹Transcribing is the process of keying specific data from paper tax returns into IRS information systems and validating and verifying its accuracy.

information. At the same time, the number of tax-related documents is greatly expanding.

Tax Systems Modernization

Between the late 1960s and the early 1980s, IRS began several efforts to modernize its operations. These efforts did not succeed, and on numerous occasions the Congress expressed concern about the cost of the redesign efforts, the inadequacy of security controls over taxpayer information, the lack of clear management responsibility for the programs, and the paucity of technical and managerial expertise.

In late 1986, IRS produced plans for a new modernization effort, known today as Tax Systems Modernization (TSM). IRS estimates that TSM could cost between \$8 billion and \$10 billion through 2001. Through fiscal year 1995, IRS will have spent or obligated \$2.5 billion for TSM, which comprises 36 systems development projects. About \$1.1 billion more has been requested for fiscal year 1996.

IRS has developed a business vision to guide its modernization efforts. This vision calls for a work environment that is virtually paper-free, where taxpayer account updates are rapid and taxpayer information is readily available to IRS employees for purposes such as customer service and compliance activities.

IRS's overall redesign of its tax processing system is key to achieving this vision. An important component of the redesign is maximizing the receipt of electronic information to reduce the receipt of paper documents. IRS plans, for example, to expand the electronic receipt of tax returns.

However, IRS believes the requirement to process large volumes of paper documents will exist for the foreseeable future. As a result, IRS is designing the Document Processing System to scan paper documents and electronically capture data for subsequent processing and retrieval at workstations. This system will require staff using personal computers to correct and add data that the system cannot accurately capture from paper documents. Like its electronic filing system counterparts, the Document Processing System is to capture 100 percent of the numeric data submitted on tax returns, compared to about 40 percent captured from paper returns today.

Previously Reported TSM Problems

Throughout the modernization, we have reported on critical issues related to

- the need to build an effective organization structure for managing technology;
- problems in developing specific TSM systems and the reliability of reported TSM costs;
- weak internal, computer security, and fraud controls; and
- antiquated systems that were not designed to provide the meaningful and reliable financial information needed to effectively manage and report on IRS's operations.

Because of problems such as these, in February 1995, we designated TSM a high-risk systems modernization effort.² In general, these major efforts experience cost over-runs, are prone to delays, and often fail to meet intended mission objectives. Appendix II is a list of our prior reports and testimonies pertinent to TSM.

Objective, Scope, and Methodology

Our objective was to review the business and technical practices IRS has established to develop, manage, and operate its information systems and, in particular, the TSM initiative. We examined IRS's

- business strategy for reducing paper tax return submissions,
- strategic information management processes,
- software development capability,
- technical infrastructure, and
- systems development accountability and responsibility.

To review IRS's business strategy for reducing paper tax return submissions, we interviewed IRS officials who have responsibility for submission processing and electronic filing. We analyzed various task force studies on electronic filing and summaries of issues compiled by an IRS task team charged with promoting electronic filing.

In addition, we examined IRS internal audit reports on the performance and development of systems designed to handle paper returns, reports of problems from the service centers responsible for processing tax returns, and a risk assessment and critical design review of operational and developmental systems. Further, we reviewed project plans and technical charters for paper processing systems, and we discussed systems

²An Overview, *GAO's High-Risk Series* (GAO/HR-95-1, February 1995).

requirements and performance test results with the contractor developing the Document Processing System.

To assess IRS's strategic information management processes, we interviewed IRS officials who have responsibility for systems development. We also analyzed IRS planning documents, including IRS's Business Master Plan, Future Concept of Operations, and Integrated Transition Plan and Schedule. We obtained and analyzed IRS documentation and task force studies related to (1) planning and managing information technology, (2) analyzing systems development costs and benefits, (3) reengineering business processes, and (4) training staff in the use of new information technology.

In analyzing IRS's strategic information management practices, we drew heavily from our research on the best practices of private and public sector organizations that have been successful in improving their performance through strategic information management and technology. These fundamental best practices are discussed in our report, Executive Guide: Improving Mission Performance Through Strategic Information Management and Technology (GAO/AIMD-94-115, May 1994), and our Strategic Information Management (SIM) Self-Assessment Toolkit (GAO/Version 1.0, October 28, 1994, exposure draft).

To evaluate IRS's software development capability, we validated IRS's August 1993 assessment of its software development maturity based on the Capability Maturity Model (CMM) developed in 1984 by the Software Engineering Institute at Carnegie Mellon University. CMM establishes standards in key software development processing areas and provides a framework to evaluate a software organization's capability to consistently and predictably produce high-quality products. We discussed with IRS software development officials IRS's CMM rating and actions initiated to improve it.

We also identified and assessed IRS's initiatives to improve software development capability in key process areas, including (1) requirements management,³ (2) project planning, tracking, and oversight, and (3) configuration management. In another key process area, software

³Software requirements management involves defining, validating, and prioritizing requirements, such as functions, performance, and delivery dates.

quality assurance, we examined, in particular, IRS's use of metrics to control software development projects.⁴

To assess IRS's technical infrastructures, we discussed security and data standards with systems architects and technical specialists. In addition, we obtained and analyzed

- integrated systems architecture documents;
- systems development documents for security and data standards; and
- project plans, quality measurement plans, and technical charters for all TSM projects.

To assess accountability and responsibility for developing systems, we identified the IRS organizational components involved in developing and operating information systems. We discussed with IRS's Modernization Executive, Chief Information Officer, and research and development division officials their respective systems development roles, responsibilities, and accountability.

We performed our work at IRS headquarters in Washington, D.C., and at facilities in Cincinnati, Ohio, and Nashville, Tennessee. On April 28, 1995, we briefed the IRS Commissioner and other senior IRS executives on the results of our review and made recommendations to them for overcoming the management and technical problems impeding successful systems modernization efforts.

Our work was performed between February 1995 and June 1995, in accordance with generally accepted government auditing standards. IRS provided written comments on a draft of this report, which are included as appendix I.

⁴Software quality assurance involves monitoring the actions and products of line organizations to ensure compliance with established standards, and highlighting product or process inadequacies. Metrics, which are numerical measures presumed to predict an aspect of software quality, are useful quality indicators.

A Strategy to Maximize Electronic Filing Is Key to Modernization

IRS is currently drowning in paper—a serious problem IRS can mitigate only through electronic tax filings. But IRS will not achieve the full benefits that electronic filing can provide because it does not have a comprehensive business strategy to reach or exceed its electronic filing goal, which is 80 million electronic filings by 2001. Today, IRS's estimates and projections for individual and business returns suggest that, by 2001, as few as 39 million returns may be submitted electronically, less than half of IRS's goal.

Maximizing electronic filings is important because tax returns filed electronically do not have to move through IRS's labor-intensive operations. Paper filings have to be opened, sorted, reviewed, transcribed, shipped and stored, and then physically retrieved if IRS employees later need data on the returns that are not transcribed. IRS recognizes that increasing the number of electronic filings is essential to both improve its tax return processing and advance toward the virtually paperless environment envisioned by IRS under TSM.

Creating a paperless environment, though, will involve making significant changes to improve IRS's information management and will require new processes and new ways of doing business. Private and public sector organizations that have successfully improved their performance have found that to move away from the status quo, an organization must recognize opportunities to change and improve its fundamental business processes. Without well-conceived business strategies to capitalize on opportunities, meaningful change may be slow, the quality of service may not improve, and modernization may be impossible.

Consequently, one of IRS's most pressing modernization issues is the efficient processing of vast quantities of information received on tax returns, which in 1994, amounted to about 205 million returns. In 1995, IRS expects total tax returns from individuals and businesses to increase by 2 million, and by 2001, to reach 224 million filings.

To help process its avalanche of paperwork more efficiently, in 1990, IRS introduced nationwide electronic filing to selected groups of taxpayers as a means of using modern technology to streamline its business processes. Looking to the future, IRS set a goal to receive 80 million tax filings electronically by 2001. IRS based this goal, which accounts for about 35.7 percent of all tax filings expected in 2001, on a projection of electronic filing of 70 million individual returns and 10 million business returns.

In working toward this goal, in 1994, about 16 million tax returns, or 7.8 percent of all returns, were filed electronically, with about 50 percent of these being 1040A forms.¹ In 1995, IRS expects that electronic filings will decrease to about 15 million, or 7.2 percent of all tax returns.

On the basis of the current rate of electronic filings for individuals, IRS now estimates that in 2001 only about 29 million electronic returns will be filed by individuals. Combined with the projected 10 million electronic filings from businesses, IRS may receive only 39 million electronic returns in 2001. This is only about 17.4 percent of the 224 million tax returns anticipated in 2001, less than half of IRS's goal. Table 2.1 summarizes IRS's electronic filing activity for 1994 and projections for the future.

Table 2.1: Electronic Filing Activity and Projections

Year	Electronic filings		
	Total filings (in millions)	Number (in millions)	Percent of total
1994 (Actual)	205	16	7.8
1995 (Estimate)	207	15	7.2
2001 (Goal)	224	80	35.7
2001 (Estimate)	224	39	17.4

IRS's current business strategy focuses primarily on promoting faster refunds to clients of businesses that prepare and electronically transmit tax returns. Tax return preparers and transmitters do not pay a fee to IRS for electronic filings, but they charge a fee to taxpayers. Consequently, IRS's business strategy for promoting electronic filing is directed primarily at taxpayers who file using third parties, are willing to pay to file electronically, file simple tax returns, and are due refunds.

IRS has no comprehensive business strategy for promoting the benefits of electronic filing to other taxpayers. In doing this, IRS should consider all segments of the taxpaying population, including those who (1) are unwilling to pay for tax preparer and transmitter services, (2) owe IRS for balances due, and (3) file complex tax returns. These taxpayers represent considerable potential for making substantially greater use of electronic filing.

Moreover, IRS is not taking advantage of opportunities afforded by personal computers to increase electronic filings. In recent years, these computers have become a common fixture in many households. In this

¹Form 1040A is a simplified version of Form 1040.

regard, when personal computers are used to prepare tax returns, taxpayers who are not willing to pay commercial transmitting fees must print their electronically produced returns on paper and mail them to IRS to be manually processed. This results in the redundant, counterproductive conversion of the same data by both taxpayers and IRS: taxpayers convert electronic data to paper returns, IRS then laboriously converts information on the paper returns back to electronic data.

Unless IRS attracts all potential electronic filers, it will never achieve its vision of virtually paperless processing and will be forced to process increasingly large workloads of paper tax returns. Further, IRS's paper processing systems are not planned to accommodate the large volume of paper returns that will result if taxpayers file fewer returns electronically. For example, IRS is designing the Document Processing System for use at five service centers based on the assumption that, by 2001, at least 61 million of the 224 million returns will be filed electronically, that is, 163 million paper returns will be processed through the Document Processing System.

As table 2.1 shows, by 2001, since only 39 million tax returns may be filed electronically, 185 million taxpayers could submit paper returns, or about 22 million more returns than IRS is designing the Document Processing System to process. Thus, IRS's most recent estimates on individual filings for 2001 indicate that IRS may fall far short of its electronic filing goal, which will result in an increasing struggle to process paper filings.

Recommendation

To better achieve its virtually paperless processing environment, we recommend that IRS refocus its electronic filing business strategy to target, through aggressive marketing and education, those sectors of the taxpaying population that can file electronically most cost beneficially.

Agency Comments and Our Evaluation

IRS agreed with our recommendation regarding its electronic filing strategy. IRS said it has convened a working group, chaired by the electronic filing executive, to develop a detailed, comprehensive strategy to broaden public access to electronic filing, while also providing more incentives for practitioners and the public to file electronically.

IRS said the strategy will include approaches for taxpayers who are unwilling to pay for tax preparer and transmitter services, who owe IRS for balances due, and/or who file complex tax returns. IRS said further that the

strategy will also address that segment of the taxpaying population that would prefer to file from home by personal computers.

We believe that, by developing a more comprehensive electronic filing strategy, IRS will help to maximize the benefits possible through greater use by taxpayers of electronic filing. These benefits are central to more efficiently processing the vast quantities of information IRS receives on tax returns and, thus, to achieve the virtually paperless tax processing environment IRS hopes to attain through modernization.

IRS Is Working to Overcome Ineffective Strategic Information Management Practices

IRS is not yet effectively using a strategic information management process to plan, build, and operate its information systems. TSM has been underway for almost a decade and will require years of further development effort and substantial human and financial resources. IRS, however, does not yet have in place an effective process for selecting, prioritizing, controlling, and evaluating the progress and performance of major information systems investments.

A sound strategic information management process involves several fundamental practices: (1) applying strategic planning, (2) managing information technology as investments, (3) analyzing costs and benefits and measuring performance, (4) using business process analysis, and (5) upgrading skills and training. This process focuses on results and emphasizes simplifying and redesigning complex mission processes, which is essential to meeting mission goals and satisfying customers' needs.

IRS recognizes the importance to TSM's success of implementing a sound strategic information management process and has assessed its strategic information management using GAO's strategic information management self-assessment toolkit.¹ IRS's self-assessment identified improvements for better managing information systems. We too found serious shortcomings that underscore the urgency of IRS bolstering the strategic information management process it has begun. We also identified IRS efforts to upgrade skills and training.

Strategic Planning Is Incomplete and Inconsistent

Although IRS has developed several types of plans for carrying out its current and future operations, these plans are neither complete nor consistent. Moreover, IRS's various planning documents are not linked to each other or to TSM budget requests. Even though TSM has been underway for 10 years, complete, clear, and concise planning for TSM and its multibillion dollar investment is not evident. As a result, it is difficult for IRS to identify and effectively focus on completing priority aspects of TSM.

Public and private sector organizations that have been successful in developing major systems have found that, to be successful, once the organization has made a serious commitment to change its management of information and technology, it is paramount to adopt a strategic planning approach. Their experience is that strategic business and information system plans must have a tight link to mission goals and must be

¹Strategic Information Management (SIM) Self-Assessment Toolkit (GAO/Version 1.0, October 28, 1994 exposure draft).

predicated on satisfying explicit, high-priority customer needs. This orientation helps to ensure that information technology projects are delivered on time and within budget and that they produce meaningful improvements in cost, quality, or timeliness of service.

We identified several different efforts by IRS to prepare plans to delineate a vision for the future and actions required to realize that vision. These planning documents include

- the Business Master Plan, which reflects the business priorities set by IRS's top executives and links IRS's strategic objectives and business vision with the tactical actions needed to implement them;
- the IRS Future Concept of Operations, which articulates IRS's future business vision so that the Congress, IRS employees, and the public can see and better understand IRS's plans for serving the public; and
- the Integrated Transition Plan and Schedule, which provides a top-level view of the modernization program's tasks, activities, and schedules and is the primary tool used for accountability for delivering the products and services necessary to implement modernization.

We found, however, that these documents are incomplete and inconsistent. For example, as of May 1995, 4 volumes of the 10 volume IRS Future Concept of Operations had not been completed. These volumes covered (1) national and regional offices, (2) workload distribution management, (3) area distribution centers, and (4) process flows. While the six completed volumes include critical areas, the incomplete documents are necessary for a comprehensive vision of IRS's future operations.

Also, of the 27 action items identified in the Business Master Plan that relate to information systems, 15 could not be identified in the Integration Transition Plan and Schedule. Further, the Business Master Plan's actions and performance measures have not been changed to reflect recent electronic filing trends, which indicate that IRS will fall far short of its electronic filing goal.

We found other indications of weak planning processes as well. Specifically, IRS did not have a fully integrated planning and budgeting process for TSM, although the Office of Economic Analysis is moving in that direction. For example, this office is developing a new TSM cost model for IRS. Steps such as this are positive because a strong tie between TSM plans and IRS budgets will be especially important to ensure that

information is available to IRS managers and the Congress to show TSM's future funding needs and the results of past investments.

While IRS has undertaken fundamental TSM planning, stronger overall strategic planning for TSM is still needed. This would involve (1) defining the information technology capabilities required to support reengineered business processes, (2) identifying, assessing, and mitigating the risks involved in developing both TSM as a whole, as well as individual component projects, (3) formulating schedules and milestones for development, and (4) allocating needed resources.

Information Technology Is Not Managed as an Investment

Currently, IRS does not have a process to manage TSM information systems projects as investments, even though IRS expects the government's past and future investment in TSM to exceed \$8 billion. Foremost, at the time of our review, IRS lacked comprehensive decision criteria for controlling and evaluating TSM projects throughout their life cycles.

When organizations use strategic information management best practices, they manage information systems projects as investments, rather than expenses. These organizations view projects as efforts to improve mission performance, not as efforts to implement information technology. For public and private sector organizations that have been successful in developing major systems, the basis for making decisions on information technology investments has been an explicit set of criteria that are used to evaluate the expected mission benefits, potential risks, and estimated cost of each project. This investment focus systematically reduces inherent risks while maximizing benefits of complex projects.

IRS maintains that all TSM projects have equal priority and must be completed or the modernization will fail. An "all-or-nothing" approach to large information technology projects is usually unrealistic and generally unattainable. Instead, a reasoned and an explicit framework for managing information technology investments is essential.

IRS currently holds program control meetings to assess and control information technology. However, these meetings have generally focused on the costs and implementation schedules of individual projects, rather than on comprehensively evaluating and prioritizing risks and returns expected from these investments. Instead of using explicit criteria to measure risks and returns, IRS evaluates each project's progress using a time-line.

At the completion of our review, IRS had developed draft criteria for TSM projects. These criteria included risk and return factors (e.g., cost, project size, and mission benefit), which it plans to use for the first time during top management's review of the fiscal year 1997 budget. However, these factors were not defined so they could be used consistently to assess projects. For instance, IRS characterized project size as small, medium, large, and very large, but did not quantify these terms. Similarly, IRS has not yet defined decision criteria and quantifiable measures to assess mission benefits, risk, and cost, all of which are important to enable IRS managers to adequately select, control, and evaluate information systems projects. IRS is currently developing better decision criteria.

Managing TSM as an investment would require IRS to assess, prioritize, control, and evaluate its investment in current and planned TSM information technology projects based on explicit and consistently applied decision criteria. By adopting this approach, top management's attention would be drawn to assessing and managing risk and making the tradeoffs between continued funding of existing operations and developing new capabilities. Most important, with a disciplined process, IRS could promptly identify, and thus avoid investing in, higher-risk projects that have little potential to provide significant mission benefits. Moreover, this would reenforce accountability for improved performance.

Analyzing Costs and Benefits Is Inadequate

Contrary to best practices used by leading private and public organizations, IRS's TSM costs and benefits analysis is inadequate. As a result, IRS and the Congress do not know whether TSM information systems projects will really make a difference. Until an adequate analysis is performed and measures are defined, IRS will not know whether investments in TSM are worthwhile.

In January 1995, IRS advised the House Budget Committee that, including operating costs for the next 10 years, TSM will cost about \$13 billion and will provide over \$32 billion in benefits. However, IRS's overall cost projection is unreliable for several reasons. For example, IRS based the projection on an October 1992 TSM cost model, which IRS did not adequately update to reflect systems that have since been added to TSM, IRS's more recent business visions, and changes in TSM systems development methods.

The benefits estimate also had shortcomings. For instance, in some cases, IRS attributed to TSM the savings associated with reducing staff resources;

in other cases, IRS computed benefits based on additional revenues expected if staff were reassigned to tax collection. Although a decision to use these staff for collections may increase revenue, the additional staff—not the system—will provide this benefit. This point becomes clear when the following scenarios are considered: (1) IRS could assign additional staff to collections independent of the information system and (2) if IRS reassigns to other nonrevenue producing activities the staff years saved, the revenue benefits would evaporate even though the information system would not change. A convincing benefits analysis for a system must compare operational costs with and without the system, other variables being held constant.

IRS recognizes that it has not adequately assessed TSM costs and benefits and is currently working with a contractor on an economic analysis to better reflect the cost and benefits of TSM. IRS expects another cost and benefit analysis to be completed by September 1995. We will continue to monitor IRS's progress in analyzing TSM cost and benefits.

Reengineering Efforts Are Not Tied to Systems Development Projects

After many automated systems design and development efforts were already underway, IRS started business process reengineering, which involves critically reexamining core business processes and redesigning them to achieve significantly better performance. Compounding this problem is IRS's lack of a comprehensive plan and schedule defining how and when to integrate these business reengineering efforts with on-going TSM projects.

Organizations that successfully develop systems do so only after analyzing and redesigning critical business processes. Information systems projects that do not consider business process redesign typically fail or reach only a fraction of their potential. Accomplishing significant improvement in performance nearly always requires streamlining or redesigning critical work processes.

IRS has identified six core business areas and defined 11 business processes that support these areas. Of these 11, 3 were selected to begin reengineering efforts. Those selected for initial redesign are (1) processing returns, (2) responding to taxpayers, and (3) enforcement actions.

Overall, we found IRS's reengineering methods to be consistent with generally recognized business process reengineering principles. IRS had, for example, assessed some existing data on customer values, analyzed

current processes, and designed target processes and plans to validate the target designs. Further, IRS has a project management structure consisting of process owners, an executive steering committee, project managers, cross-functional teams, and contractor support to ensure that all stakeholders can participate. However, these efforts are not yet complete, and IRS did not assess the actual steps needed to implement these efforts.

IRS officials acknowledge that reengineering efforts began after the start of many TSM systems projects. Until reengineering is sufficiently completed to drive TSM projects, there is no assurance that the projects will achieve the desired business objectives and result in improved operations.

IRS Is Working to Upgrade Skills and Training

IRS is currently reassessing its skill and competency base to ensure that its personnel and training programs will meet future needs. Operating and maintaining progressively sophisticated systems, such as those comprising TSM, requires continuously higher skill levels and updated knowledge—an additional critical factor for success, according to best-practice organizations. Antiquated skill bases can inhibit an organization's ability to change.

IRS has several initiatives planned and underway to upgrade the skills of its personnel. For example, IRS

- has defined positions needing competency assessments;
- plans to assess staff skills using competency assessment instruments, which are currently being developed; and
- is reorganizing and strengthening its training program by establishing a Corporate Education unit.

We are currently assessing IRS's human resource planning for modernization and will continue to monitor progress in this area.

Recommendations

To address IRS's strategic information management weaknesses, we recommend that the IRS Commissioner take immediate action to implement a complete process for selecting, prioritizing, controlling, and evaluating the progress and performance of all major information systems investments, both new and ongoing, including explicit decision criteria.

We also recommend that IRS use these criteria to review all planned and ongoing systems investments by June 30, 1995. Meeting this time frame is

important so that the Congress has a sound basis for determining IRS's fiscal year 1996 appropriations.

Agency Comments and Our Evaluation

IRS agreed with our recommendations to improve its strategic information management. In addition, IRS said that it had recently completed a self-assessment of its practices compared to GAO's best practices for strategic information management. According to IRS, its self-assessment confirmed GAO's findings and will help strengthen IRS's overall response to GAO's concerns.

In response to our recommendations, IRS said that it

- will continue to work on simplifying and ensuring the consistency of all its key planning documents;
- has initiated a priority setting process for meeting business needs through information system investments;
- has developed an initial set of investment evaluation criteria for use as part of an ongoing process to evaluate spending plans for information systems;
- has completed a comprehensive review of the proposed fiscal year 1996 budget for TSM, which will enable IRS to rescope its program objectives, set priorities, and adjust funding levels for TSM;
- will continue to refine the investment evaluation criteria and also institutionalize a formal process based on the use of this criteria; and
- is developing and implementing the use of an information technology investments alternative to select, prioritize, control, and evaluate information technology investments to achieve reengineered program missions.

Actions such as these could provide IRS the underpinnings it needs for strategic information management. IRS indicated that progress toward implementing these improvements will be monitored by the IRS's Associate Commissioner. We believe that this is essential to ensure prompt and effective implementation.

Regarding a cost and benefits analysis, IRS said that the September 1995 analysis will address the costs and benefits of TSM and allow IRS to identify and focus on competing priorities. In particular, IRS expects the new analysis to reflect a much more extensive benefit estimate than IRS currently has available. We believe an adequate cost and benefits analysis will help IRS to know whether investments in TSM are worthwhile.

Regarding skills and training, IRS said that it is taking steps to ensure that personnel and training programs meet future needs, especially those relating to information systems. These steps include (1) establishing a training steering committee to consolidate all information systems training currently underway, with the goal of increasing the skill level of IRS employees and (2) identifying job requirements for information systems professionals, which IRS will use in developing training and education programs that are directly linked to mission needs and critical occupational performance goals.

Although IRS is in the process of identifying job requirements, we believe that, until reengineering is complete, IRS can only incorporate prototype job requirements into its training and development efforts. In addition, IRS's current plans do not address how job requirements created as a result of reengineering efforts will be incorporated into its training environment.

Software Development Process Is Weak but Improvements Are Underway

IRS's software development activities are inconsistent and poorly controlled because IRS has few detailed procedures for its engineers to follow in developing software. IRS's software development deficiencies can greatly affect the quality, timeliness, and cost-effectiveness of TSM. Unless IRS improves its software development capability, it is unlikely to build TSM timely or economically and systems are unlikely to perform as intended.

To assess its software capability, in September 1993, IRS rated itself against a Capability Maturity Model (CMM) designed by the Software Engineering Institute, a nationally recognized authority in the area. IRS found that, even though TSM is a world-class undertaking, its software development capability is immature. IRS placed its software development capability at the lowest level, described as ad hoc and sometimes chaotic and indicating significant weaknesses in software development capability.

Realizing that its software development capability needed improvement, IRS initiated process action teams to address software development weaknesses in key process areas. These teams have made varying degrees of progress to improve IRS's software development capability and define uniform procedures in the key process areas.

Their progress notwithstanding, substantial additional improvement is necessary before IRS's software development capability can be upgraded to at least the next CMM level, where its activities would be more disciplined and considered to be repeatable. Whether software development is done by IRS, which has nearly 2,000 people working in the area, or by contractors, mature software development capabilities are key to quality, timely, and cost-effective TSM software development.

Closely associated with one key software development process area, software quality assurance, is the use of software metrics, which are numerical measures used to predict an aspect of software quality. In this regard, we found that IRS has not adequately defined a suite of metrics. Moreover, IRS is not consistently or effectively using even its limited metrics for assessing the quality of software development projects throughout their life cycles.

Software Development Capability Is Immature

The Software Engineering Institute was established at Carnegie Mellon University in 1984 primarily to address the Defense Department's software development problems. In 1991, the Institute developed CMM for use by organizations to evaluate their capability to consistently and predictably produce high-quality software. Table 4.1 describes CMM's five maturity levels.

Table 4.1: CMM Levels and Descriptions

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

IRS rated itself at CMM level 1 because its assessment showed significant weaknesses in all key process areas prescribed for an organization to attain a level 2 capability. The key process areas designated by the Institute as necessary to reach CMM level 2 include (1) requirements management, (2) software project planning, (3) software project tracking and oversight, (4) software quality assurance, and (5) software configuration management.

Further, the National Research Council also identified IRS's software development weaknesses and, in its Fall 1994 report on TSM,¹ stated that IRS needed to develop a mature software development organization. The Council reported that, compared to accepted modern standards, IRS's internal development capability is largely out of date and rudimentary.

Software Development Improvement Initiatives Are Progressing

To improve its software development capability and attain a higher CMM rating, the IRS Information Systems Organization's Applications Design and Development Management group initiated five process action teams to address the weaknesses identified by IRS's assessment and the National Research Council's review. Table 4.2 identifies the teams and describes the key process areas each was to address.

Table 4.2: IRS Teams Addressing Key Software Development Process Areas

Team	Areas to be addressed
Requirements Management	Defining, validating, and prioritizing requirements, such as functions, performance, and delivery dates.
Software Quality Assurance	Monitoring the actions and products of line organizations to ensure compliance with established standards, and highlighting product or process inadequacies.
Project Planning and Tracking	Ensuring that project plans define what is to be done, at what cost, by whom, and on what schedule, and establishing criteria for tracking projects.
Testing	Defining procedures for the testing of software units and systems and for acceptance testing.
Configuration Management	Selecting project baseline items, such as specifications; systematically controlling these items and changes to them; and recording and reporting status and change activity for these items.

The following discussion highlights the work of these teams, which we found in various stages of completion. Although the teams have generally

¹Continued Review of the Tax Systems Modernization of the Internal Revenue Service (Interim Report), Computer Science and Telecommunications Board, National Research Council.

made progress, IRS's software development capabilities remain weak in each of the key process areas they were to address.

- The Requirements Management team (1) studied and flow charted the process for requesting information services and (2) generated and is delivering related training materials. However, the requirements management process developed by the team is currently being applied to only legacy systems (i.e., existing IRS systems). An equivalent requirements management process for TSM systems was still under development. Also, customer involvement with the team's requirements management process has been limited.
- The Software Quality Assurance team adopted the peer review portion of a planning, review, and inspection process developed by IRS's Quality Assurance Group. The team is applying this process to selected projects and has developed training for using the process, which IRS is giving to its systems engineers. However, IRS has not yet decided whether to conduct the team's peer review approach on all projects. Also, IRS has yet to define detailed procedures for performing other software quality assurance functions, such as (1) ensuring compliance of software products and processes with defined standards, (2) independent verification of product quality, (3) periodic audits and reviews by the Software Quality Assurance group, and (4) feedback of the software quality assurance activities and findings to facilitate improvement of the process.
- The Project Planning and Tracking team selected a software tool for planning and tracking the progress of software development projects. Because the team did not prepare guidelines specifying the minimum planning and tracking elements to apply to projects, project managers who use the software must define the details to track. As a result, this tool is being inconsistently used and, thus, IRS has been unable to consistently track the progress of their projects.
- The Testing team has issued guidance on unit testing. However, there are no procedures for systems and acceptance testing.
- The Configuration Management team is waiting for configuration management of the corporate-level to be defined in order to define lower-level processes and procedures. The only configuration management in place is version control of software.² As a result, important items are not yet under configuration management, including documentation, and software development folders.

²Version control is the process of certifying and releasing improved versions of software and its documentation in a controlled manner (as opposed to making ad hoc untested and unvalidated changes).

Although the teams have made progress, their accomplishments have not significantly improved IRS's software development capability. Foremost, IRS has not developed and implemented consistent guidelines and procedures in the key process areas essential at CMM level 2. Unless IRS's weaknesses in software quality assurance and software configuration management are corrected, IRS faces a much greater risk of extensive rework, schedule slippage, and cost overruns in developing software.

This risk is present whether IRS or a contractor develops TSM software. In this regard, to effectively oversee a contractor's work to develop software, and thereby help to ensure prompt and successful completion of the software, it is important for IRS's software project managers to understand the practices needed to develop software at CMM level 2. To further mitigate the risk of potential problems in developing software under contracts, it is critical that IRS's software development contractors not be at CMM level 1. IRS does not, however, require all of its software development contractors to be at least at CMM level 2.

Metrics Are Not Consistently Used

Although not a specific key process area for rating an organization's software capabilities, it is nonetheless crucial that a set of quality indicators, and their associated measures, called metrics, be used to assess the quality of software development throughout a project. IRS has not yet effectively established such a measurement process.

Early detection and avoidance of problems and control of software development projects are possible through the collection, validation, and analysis of metrics, which are numerical measures presumed to predict an aspect of software quality. Useful metrics include numbers of defects found at various stages of development, costs to repair defects, and the extent of test coverage.

Basically, metrics, such as the number and frequency of errors associated with a specific section of software, are taken to analyze the quality of software. Such analyses can identify situations where quality is unacceptable or questionable. In this way, the metrics are validated against quality factors throughout a software development project.

According to IRS officials responsible for software development, IRS has not yet defined a complete suite of metrics to be used in the software development program to assess the on-going quality of TSM projects. IRS's

present use of metrics allows for only one type of metric, collectively called function points.³

Even so, IRS's use of function points for assessing all software development projects is inconsistent, and IRS does not have a firm schedule for full implementation throughout the agency. In addition to function points, the following metrics, would, at a minimum, also be necessary: (1) complexity, (2) personnel and effort, (3) problems/defects by development phase, and (4) cost per defect.

Further, IRS's use of function points does not trace back to quality improvement goals derived from IRS's business objectives. In this regard, IRS could use the following metrics to measure software attributes related to business goals:

- Fewer product defects found by customers.
- Earlier identification and correction of defects.
- Fewer defects introduced during development.
- Faster time to market.
- Better predictability of project schedules and resources.

Without clearly establishing a suite of metrics that trace back to business objectives through quality improvement goals, and that are implemented organizationwide in a uniform and consistent manner, IRS will be hampered in assessing the progress and quality of its software projects. Moreover, the absence of a suite of metrics makes it difficult for IRS to identify the reasons certain software development practices perform well while others perform poorly. Metrics, therefore, when used organizationwide in developing software, would provide IRS a means to better ensure uniform software development, thus avoiding the potential for repeating problems that could be costly and time-consuming to correct.

Recommendations

To address IRS's software development weaknesses, we recommend that the IRS Commissioner immediately require that all future contractors who develop software for the agency have a software development capability rating of at least CMM level 2.

³Function points are used to measure a project's size, such as lines of code.

To further upgrade IRS's software development capability, we also recommend that the Commissioner take action before December 31, 1995, to

- define, implement, and enforce a consistent set of requirements management procedures for all TSM projects that goes beyond IRS's current request for information services process, and for software quality assurance, software configuration management, and project planning and tracking and
- define and implement a set of software development metrics to measure software attributes related to business goals, such as those outlined in this chapter.

Completing these actions by the end of 1995 is essential so that the Congress, in monitoring TSM's progress and acting on TSM budget requests, has assurance that IRS will be able to effectively develop, and/or oversee contractors' development of, software associated with systems modernization projects.

Agency Comments and Our Evaluation

IRS agreed with our recommendations for improving its software development capability, and is taking steps to do so. IRS said that it is committed to developing consistent procedures addressing requirements management, software quality assurance, software configuration management, and project planning and tracking.

Regarding metrics, IRS said that it is developing a comprehensive measurement plan to link process outputs to external requirements, corporate goals, and recognized industry standards. IRS said also that it has "baselined" all legacy systems using an accepted Software Engineering Institute metric.

We believe these steps, if implemented and institutionalized effectively, would provide IRS the disciplined approach necessary to improve its software development capability. Mature software development capabilities are key to quality, timely, and cost-effective TSM software development.

IRS also stated its belief that most government agencies and private organizations are not far along in raising their software development maturity profiles. We have identified several government organizations that have adopted CMM and are moving toward higher CMM levels. For

example, the Department of the Army's Information Systems Software Development Center in Virginia and the Department of the Air Force's Sacramento Air Logistics Center were both assessed by SEI authorized assessors as CMM level 3. The Air Force also has a deadline for all its software activities to reach CMM level 3 by 1998. The software development capabilities of other organizations notwithstanding, we believe that a complex and costly systems development project, such as TSM, at a minimum, would warrant a CCM level 2.

IRS Recognizes Importance of Better Systems Architectures, Integration, and Testing but These Are Not Yet Adequate

IRS is not adequately performing and managing key TSM technical activities critical to the success of a large and complex systems modernization effort. In particular, IRS has not (1) defined and completed a TSM architecture, (2) established effective processes for configuration management, (3) defined the interfaces and standards needed to ensure that TSM components successfully integrate and interoperate, and (4) defined and completed TSM testing plans and established a testing facility.

IRS recognizes that, for modernization to succeed, TSM's technical activities must be better defined, performed, and managed. Until IRS improves these areas, it is at increased risk of developing systems that are unreliable, do not meet user needs, cannot work together effectively, and require significant and costly redesign and reprogramming to correct weaknesses.

TSM Integrated System Architecture Is Incomplete

IRS has adopted a systems development methodology, known as Information Engineering, which is a formal, structured system development methodology widely used in the public and private sectors to provide a disciplined approach to information systems development. The principal deliverable of Information Engineering's first stage, Information Strategic Planning, is an integrated systems architecture.

An integrated systems architecture (1) guides and constrains system design and development by providing a balanced, top-down view of the system, which system designers need to build the system and (2) organizes system functionality and defines relationships among those functions. In establishing this guidance and functionality, it is key to define security and data architectures and standard application program interfaces.

In July 1993, IRS published an initial version of its integrated system architecture. According to this document, the TSM integrated systems architecture will be completed as other modernization work progresses. This approach defeats the purpose of an integrated systems architecture, which is to guide a system's development, not to merely document its development without formal guidance. Further, TSM security and data architectures and standard application program interfaces are incomplete and, thus, designers and developers do not have sufficient guidance to build individual TSM systems.

Security Architecture Is Incomplete

Because TSM's security architecture is incomplete, systems designers do not have sufficient guidance on how to incorporate restricted access to IRS

systems and data. IRS has made progress in defining its security requirements, but it continues to develop and implement systems without first completing the necessary security architecture and security applications.

In February 1994, IRS issued a risk assessment that identified potential security risks, determined their severity, and identified areas needing safeguards, and in October 1994, issued an information security policy. Since then, IRS has completed security documents relating to

- high-level security requirements, including mission, management, and technical security requirements;
- functional security requirements, which specify user security needs;
- a preliminary data sensitivity analysis, which is used to determine data sensitivity (e.g., sensitive but unclassified, etc.); and
- a draft information system target security architecture, which specifies TSM information security goals.

In addition, an IRS infrastructure and engineering task group has defined a set of preliminary security applications program interfaces that will guide application developers in requesting systems security functions. IRS officials told us that once these interfaces have been completed and thoroughly tested, IRS will mandate their use.

This progress notwithstanding, the TSM security architecture and security applications interfaces remain incomplete and unavailable to systems designers and developers. Without this crucial systems security guidance, IRS has no assurance that taxpayer data will be adequately protected.

Key security guidance that has not yet been developed includes

- a disaster recovery and contingency plan, which would ensure that information systems can restore operations and data in the case of sabotage, natural disaster, or other operational disruption;
- a security concept of operations, which would define IRS plans for operating in TSM's new security environment;
- a security test and evaluation plan, which would validate the operational effectiveness of system security controls;
- a security certification and accreditation plan, which would provide IRS managers and system security officers adequate assurance that the system will protect information as required by the security policy;

- a communications security plan, which would define how security controls will be implemented when sending and receiving sensitive information electronically between and among distributed TSM subsystems and external agencies that must provide tax-related information to IRS; and
- an identification and authentication plan, which would define processes to verify user identities when accessing sensitive tax data.

Security has been a serious problem with IRS's current systems. Our audits of IRS's financial statements under the Chief Financial Officers Act (Public Law 101-576) have shown that IRS's controls do not yet ensure that taxpayer data are adequately protected from unauthorized access, change, disclosure, or disaster. Specifically, IRS has not adequately (1) restricted access to taxpayer data to only those employees who need it, (2) monitored the activities of thousands of employees who were authorized to read and change taxpayer files, and (3) limited the use of computer programs to only those that have been authorized.

We have reported that,¹ as a result, IRS did not have reasonable assurance that the confidentiality and accuracy of these data were protected and that the data were not manipulated for purposes of personal gain. IRS's own reviews have identified instances where IRS employees (1) manipulated taxpayer records to generate unauthorized refunds, (2) accessed taxpayer records to monitor the processing of fraudulent returns, and (3) browsed taxpayer accounts that were unrelated to their work, including those of friends, relatives, and neighbors.

Data Architecture Reflects Existing Processes Rather Than Reengineered Processes

IRS is perpetuating its current data weaknesses by continuing to build TSM systems without the guidance afforded by a data architecture that reflects reengineered processes. An IRS analysis of its current systems identified the following data weaknesses:

- Updated data on one system are not immediately available to users of other systems.
- Master data files are updated once a week, and it can take up to 2 weeks for data in a taxpayer account to be changed.
- Inconsistent and incomplete data on different systems can affect fundamental computations and can result, for example, in inconsistent calculations of interest and penalties.

¹Financial Audit: Examination of IRS' Fiscal Year 1993 Financial Statements (GAO/AIMD-94-120, June 15, 1994).

- Data are stored in unique formats on different systems and are accessed using various techniques.

In 1994, to address data weaknesses, IRS initiated the Corporate Accounts Processing System project. IRS is developing this project in phases over 7 years, with each phase adding new TSM functionality. Through the Corporate Accounts Processing System, IRS expects to provide more efficient access to data, reduce data redundancy, and improve data integrity.

Nonetheless, the success of the Corporate Accounts Processing System project depends on improving current business processes through reengineering. At the time of our review, however, the project was modeling IRS's existing business processes because IRS had not completed its reengineering.

To effectively correct existing data weaknesses that IRS identified and that the Corporate Accounts Processing System project is to address, IRS must first define how its business processes will be reengineered. Only then will IRS be in a strong position to build new systems based on a data architecture that reflects reengineered business processes.

Standard Application Program Interfaces Are Not Defined

Standard application program interfaces are essential to guide systems development because they define how applications software can access and use standard functions and services (e.g., communications services). These interfaces provide many systems development benefits, including improved interoperability, consistent implementation, less complex applications, standardized software coding, and simplified maintenance.

Realizing the benefits of providing standard application program interfaces for system development, IRS has established an interface task group and initiated an effort to define, code, test, and document standard application program interfaces for TSM. IRS has drafted an infrastructure services manual to provide an explanation of infrastructure services that will be available to systems developers. IRS also expects to prepare a more comprehensive and detailed manual describing application processing interfaces.

However, many TSM standard application program interfaces are not yet defined, implemented, or documented. Nonetheless, IRS is continuing to build TSM projects. As a result, these projects are likely to require

modification once standard application program interfaces are defined and required.

Effective Configuration Management Practices Are Not Established

Systems change throughout their life cycle to (1) improve systems designs and operations and facilitate maintenance, (2) reflect changing mission requirements, and (3) respond to changes in the budget and schedules. These changes must be controlled through configuration management to ensure that they are cost-effective and properly implemented, documented, and tested.

Configuration management ensures that the integrity and stability of a system are preserved as it is designed, built, operated, and changed. Configuration management is also important for making engineering and trade-off decisions, maintaining up-to-date systems descriptions, and tracking every system component.

In 1994, IRS established an Information System Configuration Control Board to manage and control all systems changes. However, the Board has focused on monitoring individual project costs and schedules and developing configuration management guidance. A process has not yet been established to manage systems changes. Further, IRS does not have a configuration management plan that precisely defines the processes to be implemented, how and when they will be implemented, and who will be responsible for performing specific configuration management functions.

Systems Integration Planning Is Incomplete

In 1992, IRS initiated an effort to design and develop both a comprehensive integration strategy and a programwide integration plan to help IRS successfully transition from its current environment to one that meets TSM-defined objectives and capabilities. A preliminary strategy described by IRS's Executive for Systems Architecture was for (1) an integration approach that included a methodology to integrate current and future initiatives into the TSM systems architecture, (2) an associated problem detection and resolution process, and (3) the analysis processes (e.g., testing and quality assurance) required to ensure projects are being, and have been, successfully integrated. The preliminary strategy addressed both the integration of individual projects and the transition of all projects to an integrated processing environment.

Since then, little has been done to complete a comprehensive integration strategy or develop an integration plan that defines implementation

guidance and processes. In 1994, IRS planned to perform further work on integration management, but did not fund this effort in either fiscal year 1994 or fiscal year 1995. Until there is an effective integration process and a completed integration plan in place, IRS will have little assurance that its systems modernization components will operate effectively together.

System Testing and Test Planning Are Inadequate

An organization performs system testing to detect system design and development errors and correct them before putting a system into operation. Inadequate testing increases the likelihood that errors will be undetected, reduces the extent to which a system can provide accurate and reliable processing services and information, and, because the discovery of errors is likely to be delayed, increases the cost of modifying the system.

A testing plan ensures that sufficient testing is done during system development and prior to deployment. The plan defines, for example, what is to be accomplished during testing, who is to do the testing, where it is to be performed, and what constitutes success.

IRS acknowledges the importance of testing in the development of TSM systems, but has not yet developed a complete and comprehensive testing plan for TSM. In addition, individual TSM system development projects are developing their own testing plans. IRS describes these individual testing plans as rudimentary and inadequate. As a result, IRS has no assurance that its individual systems will be thoroughly and consistently tested or that systems will perform correctly or effectively.

Currently, IRS performs system development testing in an operational environment using taxpayer data at its service centers or computer centers. Because tax processing production work at these facilities has a higher priority than testing, the time, computer, and human resources applied to testing, as well as the resulting depth of testing, are limited. This limitation seriously affects testing quality and completeness. This testing environment also introduces the possibility that testing can, under unforeseen circumstances, affect and disrupt production.

To help overcome this situation, IRS plans to establish an Integration Test and Control Facility to provide an environment that will more effectively support the testing and integration of legacy and TSM systems. By establishing this testing facility, IRS expects to (1) improve the quality of delivered software, (2) provide information resources needed for testing

and integration, and (3) reduce risks in integrating and transitioning from current legacy systems to TSM.

In September 1994, IRS developed a concept of operations for the integrated testing facility, which describes its functions and responsibilities. IRS has been working with a contractor to define the facility's functions and responsibilities. IRS is also working with the General Services Administration to select a facility site. However, until IRS completes its testing plans, implements effective testing processes, and establishes its Integration Test and Control Facility, it has little assurance that systems will be adequately and effectively tested.

Recommendations

To address IRS's technical infrastructure weaknesses, we recommend that, before December 31, 1995, the IRS Commissioner

- complete an integrated systems architecture, including security, telecommunications, network management, and data management;
- institutionalize formal configuration management for all newly approved projects and upgrades and develop a plan to bring ongoing projects under formal configuration management;
- develop security concept of operations, disaster recovery, and contingency plans for the modernization vision and ensure that these requirements are addressed when developing information system projects;
- develop a testing and evaluation master plan for the modernization;
- establish an integration testing and control facility; and
- complete the modernization integration plan and ensure that projects are monitored for compliance with modernization architectures.

Completion of these actions in 1995 is essential so that the Congress, in carrying out its oversight role and making TSM funding decisions, has assurance that the government's TSM investment is adequately protected through effective management of the technical aspects of tax processing modernization.

Agency Comments and Our Evaluation

IRS agreed with our recommendations to improve its systems architectures, testing, and integration. IRS commented that it is identifying the necessary actions to ensure that defined systems development standards and architectures are enforced agencywide. IRS said also that it

- is planning for its 1996 IRS Information System Architecture to reflect a total system view;
- is reviewing existing documentation to determine how best to incorporate our security architecture recommendation;
- is in the process of improving its configuration management process by implementing change control, as well as developing guidance;
- has initiated a series of assessments for major TSM systems to review and baseline existing requirements for each deliverable, including documented interfaces;
- will merge integration testing, systems testing, and other testing-related personnel in one facility, and is planning to establish an interim test and control capability; and
- has developed a release engineering approach to transition from its current environment to one meeting TSM-defined objectives and capabilities.

We believe that actions to improve TSM's technical infrastructure, such as those IRS has outlined in its comments, are necessary prerequisites to adequately develop and implement new systems. In addition, while release engineering can facilitate the transition from IRS's current environment to one meeting TSM-defined objectives and capabilities, to be successful, it must be closely coordinated with requirements and configuration management.

IRS Recently Acted to Strengthen Accountability and Responsibility for Systems Modernization

Effective overall systems modernization management is important because TSM is not a one-time, turnkey replacement of all current subsystems; rather, it is a target system that will be reached by incrementally upgrading or replacing operational subsystems. Consequently, to successfully implement IRS's systems modernization, an organizational structure must be in place to consistently manage and control all systems development efforts. This organizational structure would provide accountability and responsibility for all systems investments, including prioritizing new modernization systems and upgrades and maintaining all operational systems.

However, below the Commissioner's Office, the management authority and control needed to modernize tax processing has been fragmented. Until recently, IRS's Modernization Executive was responsible for developing TSM information systems until they became operational. Under this executive, each TSM system was managed by a program control group that was tasked with reviewing the project, making milestone decisions, and mitigating project risks.

In addition, the Chief Information Officer was responsible for developing non-TSM systems and for the operation of all IRS systems. This included the TSM systems that were developed by the Modernization Executive and that had been in operation for about 1 year.

In addition to systems development and operations being managed and controlled by the Modernization Executive and the Chief Information Officer, several systems development projects were managed and controlled by IRS's research and development division. For example, this division's staff of 30 information specialists developed both Telefile¹ and the Filing Fraud system, which are TSM systems. Neither the Modernization Executive nor the Chief Information Officer had decision-making responsibility for these systems or the authority to ensure compliance with IRS system development standards and practices.

During our April 28, 1995, meeting with the IRS Commissioner, we recommended that she establish consolidated, organizationwide control over all information systems investments, including all new systems in research and development and operational systems being upgraded and replaced. In May 1995, the Modernization Executive was named Associate Commissioner and given responsibility to manage and control all system

¹Telefile is a system tax filers can use to input 1040EZ tax return information through touch-tone phones.

development efforts that had previously been the responsibility of the Modernization Executive and the Chief Information Officer. However, the research and development division still does not report to the Associate Commissioner.

It is critical that the Associate Commissioner now establish organizationwide system modernization accountability and address the problems this report discusses. This entails

- ensuring strategic planning documents are complete and consistent;
- developing a comprehensive plan and schedule for linking reengineering efforts to systems development projects;
- exercising consolidated control over all information systems investments, including all new systems in research and development and operational systems being upgraded and replaced; and
- ensuring that defined systems development standards and architectures are enforced.

Recommendation

To fully strengthen systems development accountability and responsibility, we recommend that the IRS Commissioner give the Associate Commissioner management and control responsibility for all systems development activities, including those of IRS's research and development division.

Agency Comments and Our Evaluation

In commenting on a draft of this report, IRS reiterated that the Associate Commissioner is responsible for all aspects of modernization program planning and management, budget formulation and execution, and information systems development and management. Further, IRS said that it was considering whether the Associate Commissioner's systems development responsibilities are to include those of the research and development division.

We strongly urge IRS to also place with the Associate Commissioner accountability and responsibility for the research and development division's systems development activities. By doing so, IRS will help to ensure that systems development efforts are consistently managed and controlled organizationwide.

Comments From the Internal Revenue Service



COMMISSIONER

DEPARTMENT OF THE TREASURY
INTERNAL REVENUE SERVICE
WASHINGTON, D.C. 20224

June 21, 1995

Mr. Gene L. Dodaro
Assistant Comptroller General
United States General Accounting Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Gene:

We appreciate the willingness of you and your staff to conduct a comprehensive review of the IRS Tax Systems Modernization (TSM) program. As we discussed with you and the Comptroller General on March 1, 1995, such a review was needed so that both the IRS and GAO reach a common understanding of the critical issues involved in modernizing the tax administration system and in our ability to complete the Tax Systems Modernization program. I believe that the review accomplished this goal. I also believe that you and your staff appreciate that without Tax Systems Modernization the IRS will not be able to achieve its Business Vision or meet the challenges of tax administration in the future.

Over the past several years, the IRS has made substantial progress toward modernizing the tax system; the benefits to taxpayers and the government are already being realized. We also have responded aggressively to the program management and implementation issues raised previously by GAO, the Congress and other external experts including the National Research Council.

The IRS' achievements have put us at the forefront of the Administration's efforts to create a government that works better and costs less. Our progress to date merely reflects the beginning many changes that lie ahead. Modernizing our tax system is a large and complex task with many challenges. We are committed to taking the necessary steps to further strengthen our overall management of Tax Systems Modernization.

We agree with your recommendations for improvement in such areas as accountability and responsibility, electronic filing, strategic information management, software development and technical infrastructure. We already have taken steps to implement several critical recommendations including:

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Mr. Gene L. Dodaro

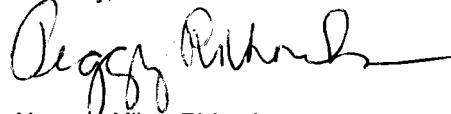
- establishing the position of Associate Commissioner to provide the leadership and organizational structure needed to deliver TSM;
- conducting a critical program review to rescope our program objectives, set priorities and adjust funding levels for TSM; and
- developing a comprehensive strategy that will broaden public access to electronic filing, while simultaneously providing more incentives for practitioners and the public to file electronically.

A summary of the actions we have taken and plan to undertake in the future is enclosed. In addition, we are developing a detailed action plan to implement all of your recommendations. We will make every effort to implement these changes by December 1995, although resource shortages and operational priorities, such as implementing tax law changes for the upcoming filing season, may impact our plans.

The action plan that we are developing will also incorporate the findings and recommendations from our Best Practices initiative. With input from our executives and managers, we recently completed a self-assessment of how the IRS' practices compare to GAO's "Best Practices" for strategic information management. As you know, the IRS is the first federal agency to complete the self-assessment relying on an extensive analysis by both field and headquarters staff. The expert assistance of members of the Accounting and Information Management Division, especially Chris Hoenig and Dave McClure, in helping us work with Treasury, IRS and GAO to improve the management of TSM was greatly appreciated. The self-assessment confirms GAO's findings and will help us strengthen our overall response to your concerns. The IRS' progress toward implementing all these improvements will be monitored closely by the Associate Commissioner Designee to ensure that the necessary actions are completed on a timely basis.

We appreciate your assistance in conducting this review and look forward to continuing to work with you in this important effort to modernize the tax system. I would be happy to share a copy of our action plan with you when it is completed later this summer.

Sincerely,



Margaret Milner Richardson

Enclosure

**IRS COMMENTS ON GAO DRAFT REPORT ENTITLED
TAX SYSTEMS MODERNIZATION: MANAGEMENT AND TECHNICAL WEAKNESSES
MUST BE CORRECTED IF MODERNIZATION IS TO SUCCEED**

ACCOUNTABILITY AND RESPONSIBILITY

RECOMMENDATION:

The IRS Commissioner should give the Associate Commissioner management and control responsibility for all systems development activities, including those of IRS' research and development division.

COMMENT:

In May 1995, the Modernization Executive position was reestablished as the Associate Commissioner to provide the leadership and organizational structure needed to deliver Tax Systems Modernization. The Associate Commissioner reports directly to the Commissioner and Deputy Commissioner and will exercise line authority over the Chief Information Officer organization. The Associate Commissioner is, among other things, responsible for all aspects of modernization program planning and management, budget formulation and execution and information systems development and management. IRS is currently considering GAO's most recent recommendation that the Associate Commissioner's system development responsibilities also include those of IRS' research and development division.

RECOMMENDATION:

The Associate Commissioner should establish organizationwide system modernization accountability and address the problems this report discusses, which would entail other responsibilities such as

- ensuring strategic planning documents are complete and consistent;
- developing a comprehensive plan and schedule for linking reengineering efforts to systems development projects; and
- ensuring that defined systems development standards and architectures are enforced.

COMMENT:

GAO's comments regarding IRS strategic documents were based on an analysis of last year's Business Master Plan (BMP) and Integrated Transition Plan and Schedule (ITP/S). Since then, IRS has issued a March 1995 version of the ITP/S. The Workload Distribution Concept of Operations was completed in May.

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An update to the BMP is scheduled to be issued later this year. These most recent versions reflect a much greater degree of consistency. With the support of the Integrated Support Contract and the Illinois Institute of Technology Research Institute, IRS will continue to work on both simplifying and ensuring the consistency of all our key planning documents.

The Associate Commissioner and the Core Business System Directors are working toward integrating reengineering efforts into the overall modernization program. The Associate Commissioner and the Directors have already initiated a priority setting process for meeting business needs through information systems investments. This greater coordination will enable IRS to better link information systems investments to our reengineering efforts.

Finally, IRS is identifying the necessary actions to ensure that defined systems development standards and architectures are enforced Agencywide. IRS' Best Practices initiative also recognized the need for improvements in this area and recommended several short term goals for better defining and enforcing standards throughout IRS.

ELECTRONIC FILING

RECOMMENDATION:

Refocus IRS' electronic filing business strategy to target, through aggressive marketing and education, those sectors of the taxpaying population that can file electronically most cost beneficially.

COMMENT:

This Spring, IRS convened a working group chaired by the electronic filing executive to develop a detailed, comprehensive strategy to broaden public access to electronic filing, while simultaneously providing more incentives for practitioners and the public to file electronically. The strategy includes approaches for taxpayers who are unwilling to pay for tax preparer and transmitter services, who owe IRS for balances due, and/or who file complex tax returns. The strategy also addresses that segment of the taxpaying population who would prefer to file from home by personal computers.

TeleFile is an excellent example of the initiatives already underway that will make electronic means of filing more convenient for taxpayers. Through TeleFile, taxpayers can file Forms 1040EZ using their touch-tone telephone. This filing season, approximately 685,000 taxpayers used TeleFile in ten states. For the 1996 filing season, TeleFile will be available

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nationwide to all eligible Form 1040EZ filers. TeleFile will also be expanded to process joint returns.

STRATEGIC INFORMATION MANAGEMENT

RECOMMENDATION:

Improve IRS' strategic information management by implementing a complete process for selecting, prioritizing, controlling and evaluating the progress and performance of all major information systems investments, both new and ongoing, including explicit decision criteria. Using those criteria, IRS should review all planned and ongoing systems investments by June 30, 1995.

COMMENT:

IRS has developed an initial set of investment evaluation criteria. These criteria are already being used as part of an ongoing process to evaluate spending plans for information systems. IRS recently completed a comprehensive review of the proposed Fiscal Year 1996 budget for TSM. This review enabled IRS to rescope its program objectives, set priorities and adjust funding levels for TSM.

IRS will continue to refine the investment evaluation criteria and also institutionalize a formal process based on the use of this criteria. IRS is already developing and implementing the use of an information technology investments alternative model assisted by Boston University. The model will be used to assist us in selecting, prioritizing, controlling and evaluating information technology investments to achieve reengineered program missions. This is part of IRS' larger effort to manage information technology as a strategic asset including incorporating benefit, cost, schedule and risk data into an automated Financial Investment Decision Support System.

SOFTWARE DEVELOPMENT

RECOMMENDATION:

Immediately require IRS's future software development contractors to have Capability Maturity Model (CMM) level 2 maturity and by December 31, 1995 take measures that will improve IRS' software development capabilities.

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COMMENT:

IRS agrees with this recommendation and is taking the necessary steps to improve its software development capabilities. In the near future IRS will be announcing a contract award that does not include the level 2 requirement. Instead of delaying this contract, however, IRS will work within the contract to move to level 2 maturity. In addition, it is important to recognize that most government agencies and private organizations are no further along than IRS in raising their maturity profile. Few organizations, whether private or public, are presently capable of level 2 or higher maturity. In 1994, 76 percent of the organizations that had undergone assessments were rated level 1. Among government agencies, it should be noted that IRS was one of the first to initiate software process improvement efforts.

RECOMMENDATION:

Define, implement, and enforce a consistent set of procedures for requirements management that goes beyond IRS's current request for information services process, and for software quality assurance, software configuration management, and project planning and tracking.

COMMENT:

IRS is committed to developing consistent procedures addressing requirements management, software quality assurance, software configuration management, and project planning and tracking. An Information Systems Configuration Board has been established within the IRS with the overall responsibility for requirement and product control. In addition, a Configuration Management Plan and a Quality Management Plan have been issued and specific procedures will be developed to further communicate these requirements. We also will be enhancing our project planning and tracking capabilities to ensure that project plans define what is to be done, at what cost, by whom, and on what schedule, as well as establishing criteria for tracking projects.

RECOMMENDATION:

Define and implement a set of software development metrics to measure software attributes related to business goals.

COMMENT:

As part of our Systems Life Cycle Implementation Project, we will be developing a comprehensive measurement plan to link process outputs to external requirements, corporate goals and

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recognized industry standards. IRS has recently baselined all legacy systems using an accepted Software Engineering Institute metric.

TECHNICAL INFRASTRUCTURE

RECOMMENDATION:

Complete an Integrated System Architecture, including security, telecommunications, network management, and data management.

COMMENT:

The Integrated System Architecture (ISA) currently contains both an architecture and a fairly detailed design. The ISA and the Transitional Architecture are being combined into a planned 1996 IRS Information System Architecture that will reflect a total system view.

RECOMMENDATION:

Institutionalize formal configuration management for all new systems development projects and upgrades and develop a plan to bring ongoing projects under formal configuration management.

COMMENT:

In 1994 IRS established a Configuration Control Board (CCB) which approves all project charters. Among its many activities, the CCB has initiated a series of assessments for major TSM systems to review and baseline existing requirements for each deliverable, including documented interfaces and required budget and schedule. We are currently in the process of improving our configuration management process by implementing change control, as well as developing guidance. A series of plans that have already been developed, including the Configuration and Quality Management Implementation Plan and the Information System Organization Configuration Management Plan, will help us move forward on both fronts.

RECOMMENDATION:

Develop security concept of operations, disaster recovery and contingency plans for the modernization vision and ensure these requirements are addressed when developing information system projects.

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COMMENT:

IRS is reviewing existing documentation to determine how best to incorporate GAO recommendations into our strategic documents. Previous work has already been done on both a security concept of operations and a disaster recovery and contingency plan. As recently as this May, a working group was formed to develop a plan for completing the security concept of operations. We also believe that the disaster recovery and contingency plans can be developed by updating the previously prepared TSM Disaster Recovery Strategy Document.

RECOMMENDATION:

Establish an integrated test and control facility and develop a testing and evaluation master plan for the modernization.

COMMENT:

The Integration, Test and Control Facility (ITCF) is a critical component of the TSM infrastructure. It will merge integration testing, systems testing, the National Office Command Center, the National Transmittal Center, the Integration and Engineering Lab, and developmental personnel in one facility. ITCF's objective is to comprehensively integrate and test TSM subsystems, systems, components and software at one site. It also will allow for centrally managing nationwide computer systems and networks, provide software deployment and version control, and supply software development support to these activities.

IRS is currently working with the General Services Administration for possible sites for the ITCF. We are hopeful that a site can be selected this Fall. This would enable us to proceed with the initial build out of the ITCF this December with an estimated completion date of December 1996.

While the process for a permanent ITCF is underway, IRS also has an immediate need for an interim capability for such projects as the Document Processing System and the Integrated Case Processing System. IRS is planning to establish an interim test and control capability later this year. We also are identifying the necessary actions to develop a master test strategy for evaluating TSM as was recommended by GAO.

RECOMMENDATION:

Complete the modernization integration plan and ensure that projects are monitored for compliance with modernization architectures.

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COMMENT:

IRS has developed a release engineering approach to successfully transition from its current environment to one meeting TSM-defined objectives and capabilities. The release engineering approach examines the development of information systems as support to business strategies, concepts of operations, information system strategies and business priorities given budget and resource constraints. The release engineering approach considers the modernization integration plan as one aspect of the overall system development that needs to be prepared in concert with other developmental plans, specifications and efforts, such as release requirements specifications, release designs and test and evaluation master plan.

Release engineering is a more comprehensive approach than what was outlined in the preliminary integration plan. By having this broad view of the system, release engineering provides specific implementation guidance and processes needed for the development, integration and implementation of TSM efforts. It also ensures that systems developed under various TSM efforts can be properly transitioned to the integrated system as defined under the TSM system architecture.

One major deliverable of this approach is the development of the Release Definition Document (RDD). The RDD draft which was issued May 15, 1995 identifies the portions of TSM capabilities and necessary technical content for each release by fiscal year. Additional initiatives are currently underway to support successful implementation of the release engineering approach for achieving an integrated and comprehensive architectural framework.

COST BENEFIT

ISSUE:

GAO believes IRS' cost and benefit analyses are inadequate and that the benefit estimates, in particular, have shortcomings. GAO asserts that IRS incorrectly computes benefits based on both staff savings and additional revenues from reinvesting staff into revenue producing activities. GAO believes that a valid benefit analysis must compare operational costs with and without the system, factoring out other variables.

COMMENT:

IRS is developing a comprehensive TSM Economic Analysis Report which will be issued in September 1995. The report will address the costs and benefits of TSM, including revenue and other benefits such as the reduction in taxpayer burden. The

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most current cost/benefit data and the latest developments relating to IRS' Business Vision are being used in developing the report. The results and capabilities provided by the report will allow IRS to identify and focus on competing priorities and integrate TSM into IRS' overall planning and budgeting process. The benefit estimates contained in the September 1995 report will be much more extensive than the short-term study that was issued in January.

SKILLS AND TRAINING

ISSUE:

GAO recognizes that IRS has several initiatives planned and underway to upgrade the skills of its personnel. They are currently assessing IRS's human resource planning for modernization and will continue to monitor our progress in this area.

COMMENT:

IRS is taking the necessary steps to ensure that personnel and training programs meet future needs, especially those relating to information systems. A Training Steering Committee has been established to consolidate all information systems training efforts currently underway with the goal of increasing the skill level of our employees. In addition, IRS is in the process of identifying job requirements for information systems professionals which will be used in developing training and education programs that are directly linked to mission needs and critical occupational performance goals. Training and development efforts are also focused on systems development and management processes.

Related GAO Products

IRS Automation: Controlling Electronic Filing Fraud and Improper Access to Taxpayer Data (GAO/T-AIMD/GGD-94-183, July 19, 1994).

Tax Systems Modernization: Automated Underreporter Project Shows Need for Human Resource Planning (GAO/GGD-94-159, July 8, 1994).

Financial Audit: Examination of IRS' Fiscal Year 1993 Financial Statements (GAO/AIMD-94-120, June 15, 1994).

Tax Administration: IRS' New Business Vision (GAO/T-GGD-94-58, Nov. 17, 1993).

IRS Information Systems: Weaknesses Increase Risk of Fraud and Impair Reliability of Management Information (GAO/AIMD-93-34, Sept. 22, 1993).

Financial Management: IRS Lacks Accountability Over Its ADP Resources (GAO/AIMD-93-24, Aug. 5, 1993).

Tax Systems Modernization: Comments on IRS' Fiscal Year 1994 Budget Request (GAO/T-IMTEC-93-6, Apr. 27, 1993).

Tax Administration: Achieving Business and Technical Goals in Tax Systems Modernization (GAO/T-GGD-93-24, Apr. 27, 1993).

Tax Systems Modernization: Program Status and Comments on IRS' Portion of President's Request for Fiscal Year 1993 Supplemental Funds (GAO/T-IMTEC-93-3, Mar. 30, 1993).

Tax Administration: Status of Tax Systems Modernization, Tax Delinquencies, and the Tax Gap (GAO/T-GGD-93-4, Feb. 3, 1993).

Tax Administration: Opportunities to Increase the Use of Electronic Filing (GAO/GGD-93-40, Jan. 22, 1993).

Tax Administration: IRS Can Improve Controls Over Electronic Filing Fraud (GAO/GGD-93-27, Dec. 30, 1992).

Tax Systems Modernization: Concerns Over Security and Privacy Elements of the Systems Architecture (GAO/IMTEC-92-63, Sept. 21, 1992).

TSM: IRS' Key Planning Components (GAO/IMTEC-92-55R, May 22, 1992).

Tax Systems Modernization: Update on Critical Issues Facing IRS
(GAO/T-IMTEC-92-18, May 13, 1992).

Tax Systems Modernization: Input Processing Strategy Is Risky and Lacks a Sound Analytical Basis (GAO/T-IMTEC-92-15, Apr. 29, 1992).

Tax Systems Modernization: Progress Mixed in Addressing Critical Success Factors (GAO/T-IMTEC-92-13, Apr. 2, 1992).

Tax Systems Modernization: Factors Critical to Success (GAO/T-IMTEC-92-10, Mar. 10, 1992).

Tax Systems Modernization: Private Sector Modernization Efforts IRS May Want to Examine (GAO/GGD-91-133FS, Sept. 24, 1991).

Tax System Modernization: Status of On-Line Files Initiative and Telecommunications Planning (GAO/IMTEC-91-41FS, Aug. 14, 1991).

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(GAO/T-GGD-91-54, July 9, 1991).

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