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United States General Accounting Office

Report to Congressional Requesters

June 2001

BUSINESS SYSTEMS MODERNIZATION

Results of Review of IRS' Customer Account Data Engine Project

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Accountability ★ Integrity ★ Reliability

GAO-01-717

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

June 12, 2001

The Honorable Byron L. Dorgan
Chairman
The Honorable Ben Nighthorse Campbell
Ranking Minority Member
Subcommittee on Treasury and General Government
Committee on Appropriations
United States Senate

The Honorable Ernest J. Istook, Jr.
Chairman
Subcommittee on Treasury,
   Postal Service and General Government
Committee on Appropriations
House of Representatives

As part of its Business Systems Modernization program, the Internal
Revenue Service (IRS) initiated the Customer Account Data Engine
(CADE) project to modernize the agency's outdated and inefficient data
management system.[1] IRS also plans for this project to be the corporate
data source for enabling future customer service and financial management
applications. As you requested, our objectives were to determine (1) the
reported status of CADE and IRS' plans for completing the project,
(2) whether IRS is managing the relationship between CADE and the
agency's enterprise architecture[2] and current systems environment,
(3) whether IRS is managing CADE in accordance with its Enterprise Life

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[1]The current system—referred to by IRS as the master files—contains taxpayer account and
return data. There are master files for individuals, businesses, and employee retirement
plans. There is also a nonmaster file for taxpayer data that cannot be stored in the other
master files due to data format and space limitations.

[2]An enterprise architecture defines the critical attributes of an agency's collection of
information systems in both business/functional and technical/physical terms.

Cycle (ELC),[3] and (4) whether IRS is ensuring that CADE will satisfy agency business needs.

On April 20 and April 23, 2001, we briefed your respective offices on the results of our review. This report transmits our briefing and reiterates the recommendations to the Commissioner of Internal Revenue that we made in the briefing. The full briefing, including our scope and methodology, is reprinted in appendix I. In summary, we made four major points:

- IRS was over budget and behind schedule in meeting CADE's next project milestone, which is the completion of the preliminary design. Moreover, IRS expected these budget and schedule shortfalls to increase, although specific new cost and timeframe commitments had not yet been set. The budget and schedule shortfalls and their anticipated increases were due, among other things, to IRS (1) adding new requirements that created additional work, (2) introducing a new requirements definition methodology that took extra time and effort to learn and apply, and (3) ensuring that CADE's design is sufficiently defined and aligned with the enterprise architecture. IRS planned to implement CADE in two phases. The first phase, which was scheduled to occur between 2002 and 2006, will transfer tax return and account data of primarily individual taxpayers from the current system to CADE. The second phase will transfer the tax return and account data of primarily businesses, but IRS had not yet established an implementation date for this phase.
- IRS was not effectively managing the relationships between CADE and the enterprise architecture or its current systems environment. For example, IRS had not fully defined the relationships between the enterprise architecture, including CADE, and the current systems environment and was not managing these relationships using rigorous and disciplined configuration management control practices.[4] IRS also had not mapped CADE's design to the enterprise architecture to ensure that they were aligned. After we discussed these weaknesses with IRS officials, they initiated

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[3]The ELC includes the methods, processes, and products for managing information technology projects from conception, development, and deployment through operations and support. See the background section of the briefing in appendix I for a simplified diagram describing the major ELC phases and milestones.

[4]Configuration management is the means for ensuring the integrity and consistency of system modernization program and project products throughout their life cycles. Through effective configuration management, for example, integration among related projects and alignment between projects and the enterprise architecture can be achieved.

GAO-01-717 IRS' CADE Project

steps intended to address the weaknesses by June 30, 2001. The steps included fully defining the enterprise architecture, completing CADE's design, implementing configuration management control practices, and mapping CADE's design to the enterprise architecture to ensure that the two were aligned. These steps are appropriate and prudent, and if properly implemented, should effectively address identified weaknesses.

- IRS was adhering to its ELC requirements for defining the work products needed to exit project milestones. It was also taking steps to determine whether work products met ELC process and product standards. However, as previously noted, IRS had not yet fully employed several critical management controls that are intended to ensure that CADE is aligned with the enterprise architecture and integrated with other modernization projects and existing systems.

- IRS had taken steps to provide assurance that CADE will meet its business needs. IRS' ELC specifies that interested IRS business organizations be significantly involved in requirements development processes, with the goal of minimizing misunderstandings and potential rework. We verified that IRS had completed or was in the process of completing these requirements development processes. However, as noted above, IRS was not effectively employing critical management controls to align CADE with the enterprise architecture, which put CADE's ability to meet IRS business needs at risk.

Recommendations for Executive Action

To ensure that IRS fully addresses the management weaknesses associated with the acquisition and implementation of CADE, we recommend that the Commissioner of Internal Revenue expedite

- completion of a sufficiently defined version of the enterprise architecture to effectively guide and constrain CADE and other modernization projects, and
- implementation of other missing modernization management controls, including configuration management.

We also recommend to the Commissioner of Internal Revenue that CADE approval to exit Milestone 3 be conditioned upon IRS (1) having a complete validated CADE design, (2) demonstrating through the use of mappings or traceability matrices that CADE's requirements and design align with a sufficiently defined version of the enterprise architecture, and (3) implementing effective configuration management control practices.

Agency Comments

In commenting on a draft of this report, the Commissioner of Internal Revenue agreed with our recommendations and stated that IRS would continue working to implement key management controls needed to ensure CADE's success. The Commissioner's written comments are reprinted in appendix II.

We are sending copies of this report to the Chairmen and Ranking Minority Members of other Senate and House Committees and Subcommittees that have appropriations, authorization, and oversight responsibilities for the Internal Revenue Service. We are also sending copies to the Commissioner of Internal Revenue, the Secretary of the Treasury, the Chairman of the IRS Oversight Board, and the Director of the Office of Management and Budget. Copies will also be made available to others upon request.
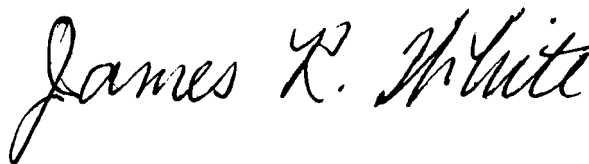
Should you or your staff have any questions on matters discussed in this report, please contact us at (202) 512-3439 or (202) 512-5595, respectively. We can also be reached by e-mail at *hiter@gao.gov* or *whitej@gao.gov.* Key contributors to this report are listed in appendix III.

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 Systems Issues

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Briefing Slides From April 20, 2001, and April 23, 2001, Briefings of the Senate and House Appropriations Subcommittee Staffs

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Information Technology

Results of GAO's Review of IRS' Customer Account Data Engine Project

Briefing to the Staffs of
the Senate Committee on Appropriations,
Subcommittee on Treasury and General Government
(on April 23, 2001)
and
the House Committee on Appropriations,
Subcommittee on Treasury, Postal Service,
and General Government
(on April 20, 2001)

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Briefing Overview

- Introduction

- Objectives

- Scope and Methodology

- Background

- Results in Brief

- Results

- Conclusions

- Recommendations

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Introduction

- IRS recognizes that its current data management system for storing tax returns and tax account data is "fundamentally deficient" because it, among other things, relies on outdated storage technology (magnetic tapes), is difficult to maintain and does not meet IRS' needs in responding to taxpayer inquiries.

- As part of its business systems modernization (BSM) program, IRS initiated the Customer Account Data Engine (CADE) project to acquire, through a prime integration contractor (PRIME), a modernized database system. CADE is to provide a single, authoritative corporate data source for enabling future customer service and financial management applications, which in turn are to allow IRS to meet its strategic performance and accountability goals.

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Objectives

- IRS' Senate and House appropriations subcommittees asked GAO to determine:

    - The reported status of CADE and IRS' plans for completing CADE;

    - Whether IRS is managing the relationship between CADE and IRS' enterprise architecture (EA) and current systems environment;

    - Whether IRS is managing CADE in accordance with its Enterprise Life Cycle (ELC); and

    - Whether IRS is ensuring that CADE will satisfy IRS' business needs.

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Scope and Methodology

- To accomplish our objectives, we:

    - Reviewed and compared planned and reported project cost, schedule, and performance data to identify any variances and their causes, and assessed IRS' near and long-term plans for completing CADE;

    - Assessed IRS' plans and controls for integrating CADE with its current environment, and reviewed the alignment of CADE's data and business requirements with IRS' EA;

    - Compared ELC-required processes and work products to CADE work products and processes, including reviewing the results of independent assessments of work products to ensure that they met ELC process and quality standards, including configuration management and change control process standards;

    - Reviewed processes and plans for developing and validating CADE business requirements and ensuring that expected benefits are achieved, and compared these efforts to ELC requirements to identify any variances;

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Scope and Methodology

- Attended and observed review sessions that were conducted by IRS to validate requirements that were defined for the design of CADE;

- Discussed the CADE project with the project director and officials, IRS business owners and representatives, the independent technical assurance contractor involved with the project, other Business Systems Modernization Office officials responsible for overseeing the project, as well as members of the PRIME team responsible for managing the project;

- As agreed, did not validate planned and actual IRS-provided cost and performance data;

- Provided a draft of this briefing on April 13, 2001 to IRS' Chief Information Officer, Associate Commissioner for Business Systems Modernization, CADE Project Director, and other executives. We have incorporated their comments where appropriate; and

- Performed our work from August 2000 through mid-April 2001 in accordance with generally accepted government auditing standards.

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Background

The Problem

- IRS currently stores taxpayer data in a 30-year-old, tape-based system that includes:

  - Master files
    - Individual Master File (IMF)--taxpayer data about individuals.
    - Business Master File--taxpayer data about businesses.
    - Employee Plan Master File--data about employee retirement plans.

  - Non-master files (data that cannot be stored in the master files because of data format and space limitations).

- The IMF alone contains about 170 million taxpayers accounts and about 13 terabytes of data--the equivalent of paper stacked 429 miles high.

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Background

- Currently, it can take IRS several weeks to process taxpayer returns and update master file accounts. This is because the accounts cannot be efficiently (i.e., without significant degradation of service) updated while business applications are accessing those accounts. This requires IRS to batch taxpayer return and account data during the week and wait until the weekend to process them.

- As a result, IRS has reported that taxpayer data are often out-of-date, inaccurate, inconsistent, and incomplete, which degrades customer service.

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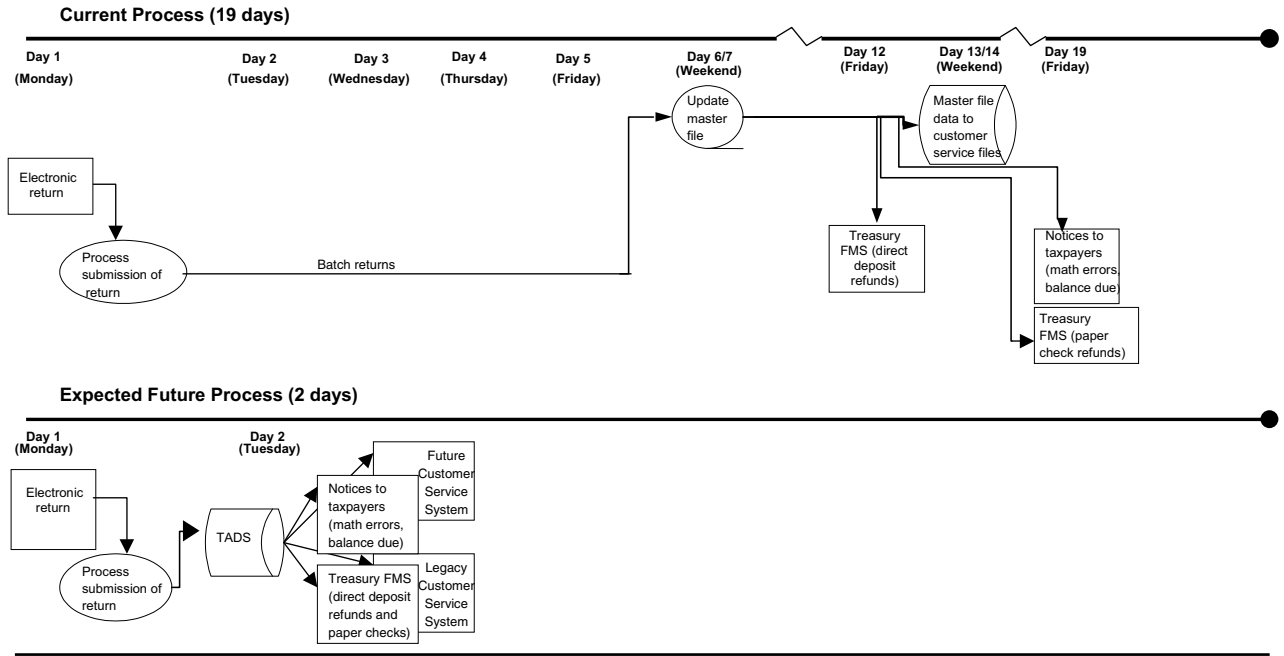**Accountability * Integrity * Reliability**

Background

The Proposed Solution

- CADE is to

  - replace the master files with a single database--the Tax Account Data Store (TADS);
  - accept, validate, and store taxpayer return and account data, along with financial account activity data, such as tax payments and liabilities, and installment agreements;
  - perform other functions, such as generating refund notices, calculating taxes, and detecting potential fraudulent transactions; and
  - enable future business application systems.

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Background

The Problem and Solution Illustrated for Processing of Electronic Returns

Current Process (19 days)

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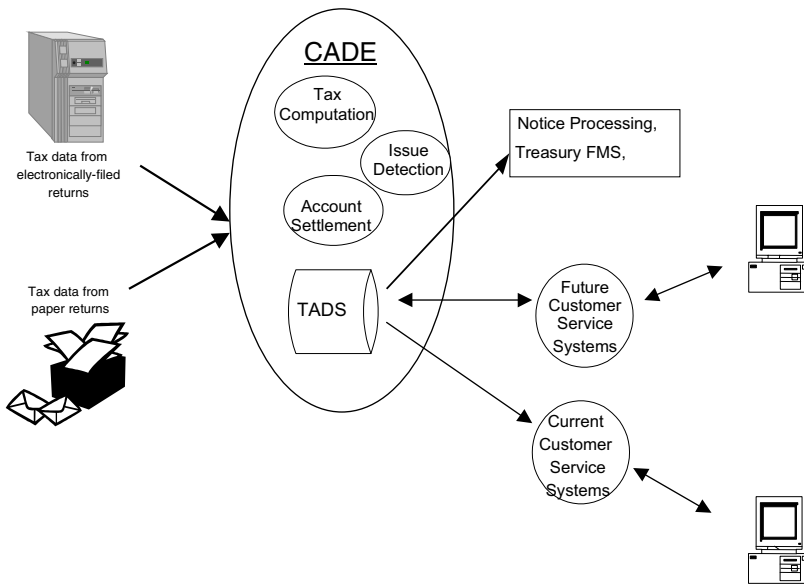**Accountability * Integrity * Reliability**

Background

The Problems and Expected Solutions Summarized

IRS-reported Problems	Solutions to be provided or enabled by CADE
Taxpayers' electronic returns take 2 weeks or longer to process and paper returns can take up to 6 weeks.	Taxpayer electronic returns can be processed within 48 hours and paper returns within 4 weeks.
Taxpayers are given incorrect and out-of-date account information.	IRS representatives are to have access to accurate and up-to-date account information; CADE is to automatically compute taxes and provide daily updating of taxpayer data.
Multiple copies of information reside on different systems with varying update schedules, producing inconsistent data.	Single, authoritative location of return and account data intended to provide consistent and accurate data.
Out-of-date account information results in incomplete or incorrect collection and other notices.	Correspondence with taxpayers are to be accurate and complete because of daily account updates.
Existing systems do not allow IRS to store enough account information to properly prepare financial statements.	Sufficient data are to exist for taxpayer account transactions to be traceable to the General Ledger. Financial transactions stored in CADE are to be linked to systems that create financial statements

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Background

Simplified Diagram of CADE and IRS' Existing and Modernized Systems

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Background

- IRS estimates CADE costs through 2009 to be about $350 million.

($M)	Costs to date	Remaining FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	Total Cost
Investment Costs (Estimated)											
Contract Labor	$ 15.00	$ 28.59	$ 35.78	$ 32.28	$ 50.72	$ 40.27	$ -	$ -	$ -	$ -	$ 202.65
IRS Labor $$ (Development)	$ -	$ 5.30	$ 5.00	$ 3.95	$ 7.49	$ 6.14	$ -	$ -	$ -	$ -	$ 27.89
Hardware / Software	$ 1.25	$ 5.50	$ -	$ 5.50	$ 5.50	$ 5.50	$ -	$ -	$ -	$ -	$ 23.24
TOTAL Investment Cost	$ 16.25	$ 39.39	$ 40.79	$ 41.73	$ 63.71	$ 51.91	$ -	$ -	$ -	$ -	$ 253.78
Operational and Maintenance (O&M) Costs (Estimated)											
IRS Labor $$ (O&M)	$ -	$ -	$ 1.04	$ 1.87	$ 0.59	$ 1.43	$ 1.43	$ 1.43	$ 1.43	$ 1.43	$ 10.67
Contract Labor	$ -	$ -	$ 7.19	$ 8.74	$ 3.05	$ 11.46	$ 12.03	$ 12.64	$ 13.27	$ 13.93	$ 82.31
TOTAL O&M Costs	$ -	$ -	$ 8.23	$ 10.62	$ 3.64	$ 12.89	$ 13.47	$ 14.07	$ 14.70	$ 15.36	$ 92.98
TOTAL LIFE CYCLE COSTS	$ 16.25	$ 39.39	$ 49.02	$ 52.35	$ 67.35	$ 64.81	$ 13.47	$ 14.07	$ 14.70	$ 15.36	$ 346.77

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Background

- Since mid-1999, we have reported on the risks IRS faces with building systems before defining its EA and instituting other program management controls (e.g., configuration management).

  - An EA is institutional blueprint defining how an enterprise operates today, in both business and technology terms, and how it wants to operate at some point in the future. An EA also includes a roadmap for transitioning between these "as is" and "to be" business and systems environments. Effective use of such blueprints, which is requirement of law, OMB, and an industry best practice, requires that system modernization investments be aligned with (i.e., traceable to and in compliance with) relevant and adequately defined EA artifacts.

  - Configuration management is the means for ensuring the integrity and consistency of system modernization program and project products throughout their life cycles. Through effective configuration management, for example, integration among related systems and alignment between projects and the EA can be achieved.

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Background

- Configuration management is but one of many management controls required under IRS' ELC, which is a structured method for managing system modernization program initiatives and projects throughout their life cycles (see below simplified diagram of ELC).

ELC Phases

ELC Milestones

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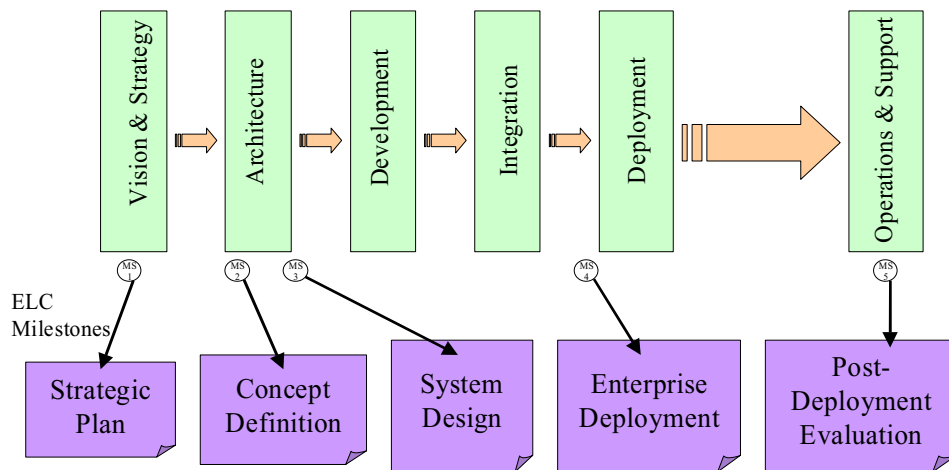
Background

- As we have reported, the risks associated with building systems without the requisite management controls are not as severe early in projects' life cycles when they are being planned (project definition and preliminary system design), but escalate as projects are built (detailed design and development). In the case of IRS and its ELC, this point of risk escalation is ELC Milestone 3.

- To mitigate these and other risks, we have made recommendations to IRS to, among other things,
  - expedite the completion of the EA and implementation of other missing modernization management controls, and
  - not approve and fund post-Milestone 3 detailed design and development activities for any project prior to instituting requisite EA and other program management controls.[1]

- IRS agreed with our recommendations.

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[1]For example, see *Tax Systems Modernization: Results of Review of IRS' Third Expenditure Plan* (GAO-01-227, January 22, 2001).

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Results in Brief

Objective 1: Status and Plans

- IRS data show that CADE is currently about $600,000 over (4 percent increase) and 3 1/2 months behind (70 percent delay) in meeting its Milestone 3 commitments (completing detailed design).

- Moreover, these Milestone 3 shortfalls are anticipated to widen, although specific new cost and timeframes have yet to be set.

- The shortfalls are due to, among other things, IRS (1) adding new requirements that created additional work, (2) introducing a new requirements definition methodology that took extra time and effort to learn and apply, and (3) ensuring that CADE's design is sufficiently defined and aligned with the EA.

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Results in Brief

- IRS plans to complete CADE in 2 phases:

	Current CADE (Phase 1)	Future CADE (Phase 2)
Implementation dates	2002 - 2006	To be determined
Master files moved to TADS	Individual master file Individual portion of non-master file Selected business master file taxpayers (small business and self-employed)	Remaining business master files Employee Plans master file Business portion of non-master file

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Results in Brief

<u>Objective 2</u>: Managing CADE Relationship with EA and Existing Systems

- The many and complex relationships between IRS' EA (future systems environment) and IRS' current systems environment are not fully defined and are not currently being managed using rigorous and disciplined configuration management control practices.

  - This is particularly significant because the state of definition of the EA and the CADE design are changing continuously as both efforts proceed concurrently.

  - IRS' mapping of EA/CADE relationship was done about 7 months ago and this mapping was between early CADE requirements and the 1997 Modernization Blueprint and its 1999 update. Since then, both CADE and the EA have changed significantly.

  - Per the ELC, such mapping should be accomplished by developing traceability matrices between the ELC required CADE requirements and design products and the ELC required EA products. For example, the CADE business requirements and the EA business process model view.

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Results in Brief

- This is also important with respect to existing systems. In fact, given the complexity and importance of effectively managing these interfaces as well as progress made to date in doing so, IRS has designated current system integration as a high risk.

- In the interim, IRS is relying on informal communications among EA, CADE, and other modernized and existing systems to design and control these complex and evolving relationships. While this interim approach has been moderately risky up to this point, it represents a more significant risk now because of the high level of development concurrency among IRS' EA, CADE, and other BSM projects, and because CADE and these projects are moving into, or are in, post-Milestone 3 life cycle phases.

- Since we discussed these control weaknesses with IRS, the agency has initiated steps that are intended to sufficiently define the EA and create a CADE system design, implement configuration management control practices, map CADE to the EA, and thereby ensure CADE alignment with the EA and integration with related modernization projects and existing systems. If properly implemented, these steps should address the weaknesses.

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Results in Brief

Objective 3: CADE Adherence to ELC

- IRS is adhering to its ELC requirements that define the products needed to exit ELC defined project milestones. It is also taking steps to assess whether the work products meet ELC process and product standards.

ELC Phases

ELC Milestones

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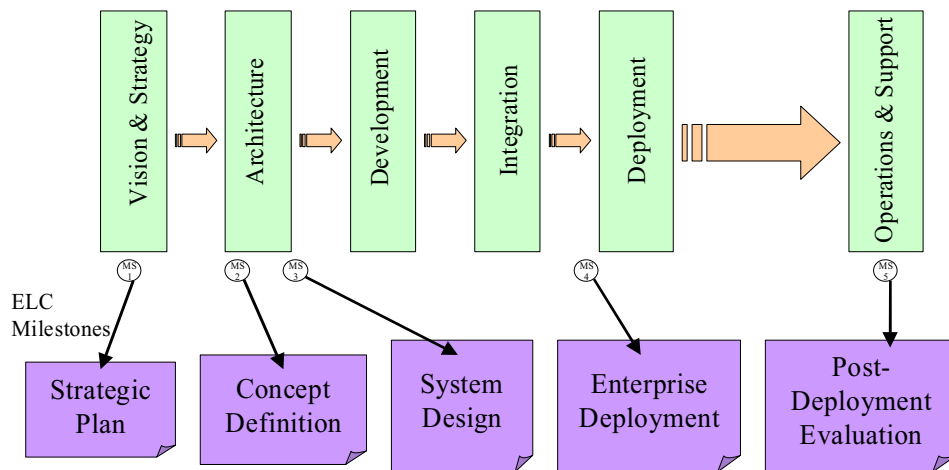
Results in Brief

- However, as previously noted, IRS has not yet fully employed several critical ELC required management controls that are intended to ensure that its modernization projects are integrated vertically with the architecture and horizontally with related modernized and existing systems. Specifically, IRS has not
  - aligned CADE's requirements and system design with a sufficiently defined version of the EA, and
  - employed rigorous and disciplined configuration management.

- Without doing so, IRS is greatly increasing the risk that its modernization projects will require costly rework to meet expectations.

- We discussed these management weaknesses with senior IRS modernization executives, including IRS' Commissioner. Since then, IRS has initiated steps, which, if properly implemented, should address the weaknesses.

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Results in Brief

Objective 4: CADE Requirements and IRS Business Needs

- IRS is taking steps to ensure that CADE will meet IRS' business needs. IRS' ELC defines a detailed requirements development process that provides for significant involvement from the IRS business organizations. We verified that IRS has or is in the process of completing some of these requirement development steps.

- However, as previously noted, IRS is not effectively employing ELC steps to effectively align CADE's requirements and design with the changing EA and manage CADE's configuration, which puts CADE's ability to meet IRS business needs at risk. To address these problems, IRS has initiated steps, which if properly implemented, should rectify each of these weaknesses.

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Results

**Objective 1: What is the reported status of CADE and what are IRS'
plans for completing the project?**

What is the reported status of CADE?

- CADE began in September 1999. IRS reports that CADE met Milestone 2 cost and schedule commitments and exited Milestone 2 on August 8, 2000.

- As of March 30, 2001, IRS reported that CADE is currently behind schedule and slightly over cost commitments for completing Milestone 3.

	Commitments made in March 2000	Revised Commitments	Change
Start date for Milestone 3	August 8, 2000	August 8, 2000	No change
End date for Milestone 3	December 31, 2000	April 9, 2001	+ 3.5 months (70% delay)
Cost to Milestone 3	$15.3 million	$15.9 million	+ $600,000 (4% increase)

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Results

- Since then, IRS has tentatively revised CADE's Milestone 3 date to May/June 2001, and anticipates additional, yet-to-be determined costs.

- According to IRS, these variances are due to
  - adding a new requirement to allow non-technical IRS employees to instruct CADE to identify and select taxpayer returns based on business-developed criteria (rather than having a computer programmer develop and test code to do this),
  - underestimating the time required to define CADE's requirements at the desired level of detail,
  - not anticipating the learning time associated with using a new requirements definition methodology, and
  - ensuring that CADE's design is sufficiently defined, including having defined interfaces to existing and modernized systems, managing CADE's configuration, and aligning CADE with the EA.

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Results

- CADE is currently in the ELC Architecture Phase, performing requirements determination and preliminary design activities required to exit Milestone 3.

What are IRS' plans for completing the project?
- IRS plans a two-phase approach to acquiring and implementing CADE.
  - Phase 1:
    - transfer to TADS in 5 incremental releases the taxpayer account and return data from the individual master file and selected parts of the business master file (small businesses and self-employed individuals) and non-master file (individuals and businesses); and
    - acquire and implement applications for each release to:
      - accept, validate, and store taxpayer data by receiving return and account data, verifying payment or refund calculations, and updating taxpayers' return and account records; and
      - generate refund information; calculate taxes, penalties, and interest; detect liabilities; and identify potential fraudulent transactions.

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Results

	Release 1	Release 2	Release 3	Release 4	Release 5
Implementation Date	To be Determined[2]	January 2003	January 2004	January 2005	January 2006
Taxpayer type	Single	Single Married Head of household	Single Married Head of household	Single Married Head of household	Single Married Head of household
Return type	1040EZ that has refund or no balance due	1040 that has refund or no balance due	1040 family Full paid, refund, or balance due	1040 with schedule C, E, or F forms 94x and 720 for 1040 customers	All individual

- Phase 2:

  - is to replace (1) the remaining parts of the business master file and non-master file and (2) employees plans master file.
  - has not yet been started as a project so implementation date has not been established.

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[2]The implementation date for Release 1 was January 2002, but IRS anticipates that the decision to extend CADE's Milestone 3 date will delay the Release 1 implementation date to later in 2002. IRS has not yet completed revising the CADE project schedule and, thus, has not yet established a new date.

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Results

Objective 2: Is IRS managing the relationship between CADE and IRS' EA and current systems environment?

- CADE is closely related to both IRS' EA (future systems environment) as well as IRS' current systems environment.

- To effectively manage such relationships, it is essential that IRS employ rigorous and disciplined information technology (IT) management controls, including

  - Development and enforcement of a sufficiently complete EA, and

  - Configuration management of BSM program and project products, including change control of requirements and design baselines.
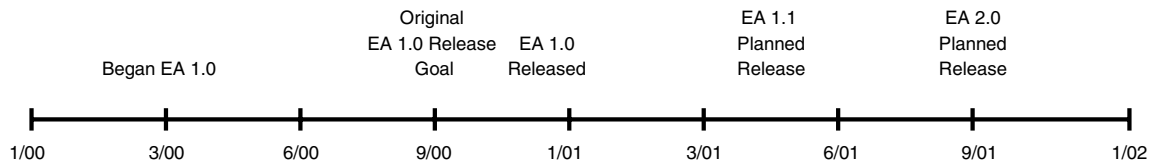
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Results

- IRS has initiatives underway to implement these controls, but they are not yet in place. Specifically, IRS has not yet
  - adequately defined the EA and CADE's design, and mapped the EA/CADE relationship to ensure they are aligned,
  - adequately defined CADE's interfaces to existing systems, and
  - effectively managed CADE's configuration.

EA Still Being Defined/CADE Mapping to Architecture Has Not Occurred

- IRS is developing its EA in 3 releases (1.0, 1.1, and 2.0).

			Original EA 1.0 Release Goal	EA 1.0 Released		EA 1.1 Planned Release		EA 2.0 Planned Release	
	Began EA 1.0								
1/00	3/00	6/00	9/00	1/01	3/01	6/01	9/01	1/02

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Results

- Prior to IRS approval of EA 1.0, an independent contractor evaluation found that it was neither complete nor adequate, and did not meet its stated objectives. Nevertheless, IRS conditionally approved EA 1.0 in December 2000, without addressing these known limitations.

- Since December 2000, IRS has made significant changes to EA 1.0 to address these limitations and other comments, and it is still deliberating how to address other EA issues. To address its immediate needs for having sufficient architectural definition to allow "near-term" projects to proceed, IRS officials stated that it has recently decided to produce a "near-term projects" or "release 2002" architecture that will be used to guide and constrain near-term modernization project investments. According to these officials, this "release 2002" architecture will be mapped to EA.

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Results

- Concurrent with these numerous completed and planned changes to EA 1.0, IRS has proceeded with defining CADE's requirements and design in order to exit Milestone 3. However, it has not

  - completed and/or decided upon key CADE design features such as the

    - application program interfaces (specification of how application software will interact with system software; in CADE's case, how business applications interact with CADE; and

    - logical data model (A representation of CADE's data, including relationships, attributes, and other details about the data). The "logical"data model is then used to develop actual or "physical" models that are used to define an implementation approach for data in a data base management system).
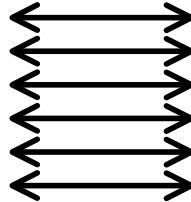
  - mapped CADE to the EA to ensure alignment.

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Results

- IRS officials stated after the CADE design is completed, they plan to map CADE to the "release 2002" architecture. Such mapping is accomplished by developing traceability matrices between CADE products and related EA products. For example,

CADE Work Products		EA Work Products
Business process requirements	⟷	Business process model view
Location requirements	⟷	Location model view
Organizational requirements	⟷	Organization model view
Data model requirements	⟷	Data model view
Technology requirements	⟷	Technology model view
Application requirements	⟷	Applications model view

- According to IRS, the "release 2002" architecture is to be completed by the end of June 2001. Open EA comments are to be addressed and included in EA 1.1 and EA 2.0.

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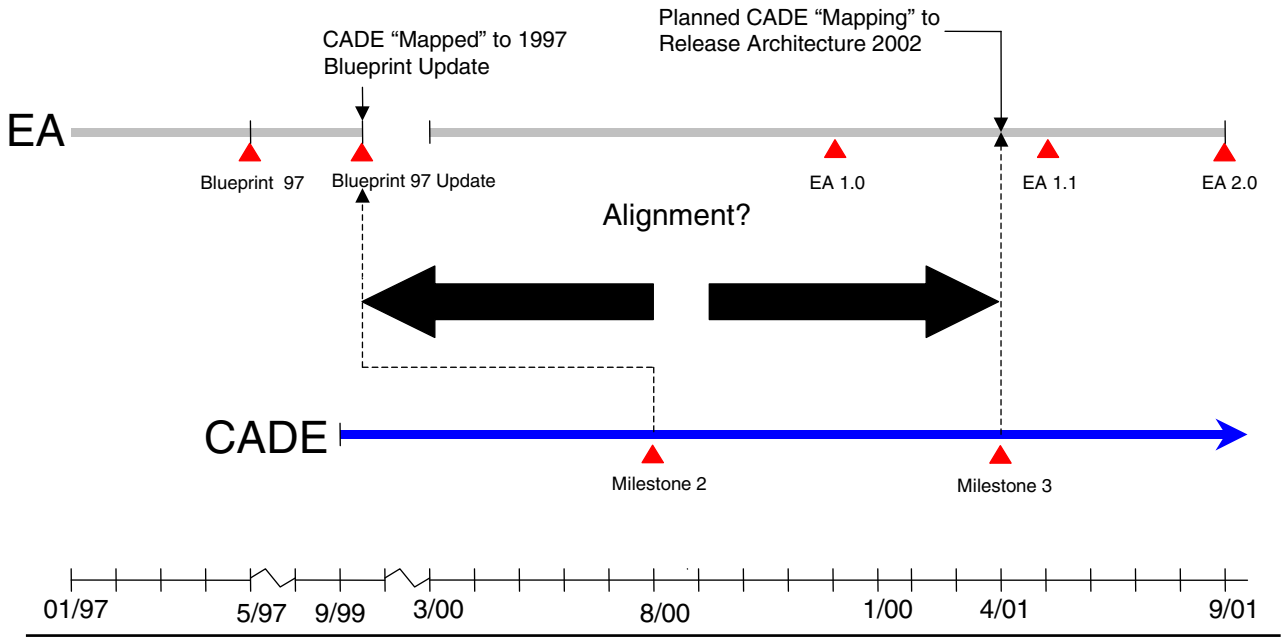
Results

IRS Working to Define CADE Relationship with Current Systems

- IRS plans for CADE to interface with about 15 existing systems that process master file data until those systems are replaced.

- IRS is in the process of defining these relationships (designing CADE) and establishing configuration control over the interface requirements, including assessing the impact on these existing systems. For example,
  - In February 2001, CADE officials submitted requests for changes to the Information Systems organization responsible for operating and maintaining IRS' current systems.
  - Joint CADE/legacy interface teams are expected to agree--via written memos of understanding--with the information systems organization on such matters as the timing, nature, and responsibility for defining and implementing these changes, including configuration management roles and responsibilities.

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Results

- According to IRS, these agreements will be used to update IRS' "Release 2002" management plan. The plan is to be updated by June 2001.
- Because of the complexity and importance of these interfaces, CADE's project managers identified this integration as high risk.

IRS Configuration Management Controls Not Being Followed

- Configuration management is the means for ensuring the integrity and consistency of system modernization program and project products throughout their life cycles. Through effective configuration management, for example, integration among related projects and alignment between projects and the EA can be achieved. According to the ELC, configuration management involves
  - preparing a list of program and project configuration items (as well as item components and subcomponents as necessary) that will be formally managed;

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Results

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- checking these items into a configuration library (repository with controlled access) to establish a baseline version against which changes will be tracked;

- evaluating, coordinating, and approving proposed changes to these items via change control boards on the basis of costs, benefits, and risks; and

- accounting for changes to the current baseline and performing configuration audits to ensure functional and physical integrity of the current baseline configuration.

- IRS and the PRIME share configuration management responsibilities.

	IRS	PRIME
Products prepared by PRIME that are under development		X
Products prepared by PRIME that are approved by IRS	X	
Oversight of PRIME Configuration Management	X	
Products prepared by IRS	X	

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- Following our inquiry, IRS in January 2001, reviewed PRIME configuration management of selected projects, including CADE, and found that key project deliverables were not under configuration control because the contractor was not following procedures. Accordingly, IRS has worked with the PRIME to develop a "get well" plan.

- In addition, IRS has yet to operationalize its configuration management function. For example,
  - Baselines for all approved products prepared by PRIME have not been established.
  - IRS and PRIME change control boards have been created and are meeting regularly, but roles and responsibilities have not been fully defined, and therefore the boards are not yet fully functional.
 - Definition of all configuration items are not to be completed until June 1, 2001.

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Results

- IRS officials stated that IRS and PRIME configuration management will be fully operational by June 30, 2001.

- In the interim, IRS will be relying on informal communication among modernization project and enterprise architecture teams. In particular, IRS is relying on individuals working on the projects to, for example, remember the nature and content of relationships, to update this information to reflect changes, and to share changes with all affected parties on the other project teams.

- IRS and PRIME officials recognize the weaknesses associated with this control approach and have stated that they are working to implement the requisite controls to ensure such a complex task is effectively managed.

- The following diagram illustrates the differences in the interim and desired configuration management approaches.

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Results

Simplified Diagram Characterizing Interim and Desired Configuration Management Approaches

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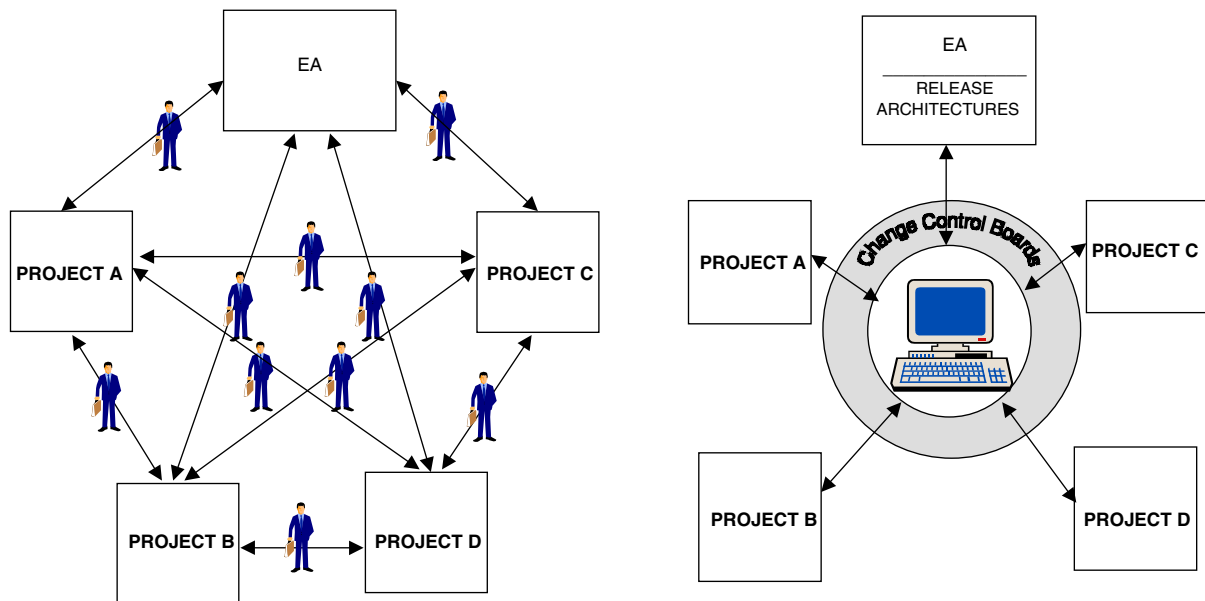
Results

Objective 3: Is IRS managing the CADE project in accordance with its ELC?

- IRS' ELC defines the methods, processes, products, and sequence of activities that are to be used to manage BSM program initiatives and projects.

- IRS completed all Milestone 2 required work products and exited Milestone 2 on August 8, 2000.
    - Milestone 2 work products provide the basis for conducting and managing Milestone 3 activities.

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Results

- IRS is currently in the process of completing all ELC products required to exit Milestone 3 and proceed with Milestone 4 activities.

ELC Work Product	Product Description	In Process	Completed
Project Management Plan	Is the agreement between the project manager and the business' project sponsor regarding the scope of work, activities, costs, schedule and deliverables for the project. Also includes other plans such as configuration management, training, risk management, and performance measurement plans used to manage the project.	✓	
Organizational Transition Plan	Provides guidance to PRIME program and IRS personnel to help them understand and perform those functions necessary to transition the existing IRS organization to an organization that can effectively operate and maintain the project.	✓	
Organizational Initiative Plan	Provides a comprehensive plan for developing, testing, and implementing all organizational initiatives identified in the Organizational Transition Plan.	✓	

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Results

ELC Work Product	Product Description	In Process	Completed
System Life Cycle Management Plan	Provides preliminary information on release planning, training, testing, logistics, and operations for the system.	✓	
Security Certification Package	Includes documents such the security risk assessment, security plan, privacy impact assessment needed to measure the level of security and privacy provided by the project.	✓	
System Requirements Report	Identifies and defines system requirements including functional, performance, and interface requirements.	✓	
System Design Report	Provides the baseline system design upon which subsequent development phase work will build.	✓	
Acquisition Management Plan	Identifies the objectives of the project and the resources required to accomplish them. Also defines how the resources will be organized and managed to accomplish the objectives.	✓	
Baseline Business Case	Documents baseline information for the project and provides justification for developing and implementing it.	✓	

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Results

- In completing Milestone 2 and working toward Milestone 3, IRS and PRIME have taken steps to ensure work product quality. For example,

    - PRIME has assigned a quality manager to CADE who is responsible for reviewing all work products. We verified that these quality reviews occurred.

    - IRS business users have periodically reviewed CADE requirements to ensure they will meet IRS' business needs.

    - IRS has employed MITRE to review all CADE work products.

- However, as previously noted, IRS has not yet not fully implemented critical ELC management controls.

    - IRS has not aligned CADE with a sufficiently defined version of EA.

    - IRS has not managed CADE configuration in accordance with the ELC.

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Results

Objective 4: Is IRS ensuring that CADE will adequately satisfy IRS' modernized business needs?

- IRS is taking steps to provide assurance that CADE requirements will meet IRS business needs.

- The ELC specifies requirements development processes that include significant involvement from interested IRS business organizations. The processes are intended to use the business to identify and specify IRS' modernized business needs and translate them into CADE requirements so as to minimize misunderstandings and potential rework .

- IRS has or is in the process of completing these steps, as displayed in the following table.

- However, as previously noted, IRS is not implementing critical ELC management controls.

  - IRS has not aligned CADE with a sufficiently defined version of EA.

  - IRS has not managed CADE configuration in accordance with the ELC.

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Results

Requirements development processes required by ELC	Completed by CADE	Examples of steps taken by CADE to satisfy ELC requirement
Project requirements are to be reviewed and approved by business representatives.	In process	IRS business representatives are validating requirements, and business executives are to approve CADE requirements.
A 14-step process is to be followed for developing, assembling, reviewing, and approving requirements.	In process	IRS is in the process of completing these steps.
Independent verification and validation personnel are to be involved in the requirements definition process to help ensure completeness and technical accuracy of the requirements.	Yes	IRS engaged MITRE to participate in customer technical reviews of the system requirements and review the system requirements report.
Once deployed, projects' actual performance is to be compared to their expected performance improvements.	Planned	IRS has defined measures to quantify performance improvements.

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Conclusions

- CADE is IRS' "linchpin" modernization project. In light of the modernization projects that depend on CADE, as well as the many interrelationships that are to exist between (1) CADE and IRS modernized applications and (2) CADE and IRS current applications, IRS must effectively manage this critical project. Without CADE, the business systems modernization program cannot succeed.

- To IRS' credit, it has made important progress on CADE, such as defining requirements and developing preliminary designs, meeting cost expectations, and following many ELC required steps.

- However, CADE has already begun to experience relatively significant schedule delays, and important management controls for effectively integrating CADE with other existing and modernized systems are not yet in place and functioning.

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Conclusions

- In particular, IRS is not effectively ensuring that CADE is aligned and consistent with the evolving EA by managing the traceability among CADE and EA products. Additionally, IRS is not effectively managing and controlling CADE's configuration in relation to the configuration of related systems. While these controls are important early in the development life cycles of systems that must work together effectively and efficiently, they are absolutely vital for systems like CADE and its related modernization projects that are advancing beyond the preliminary design and moving into phases where rework is time consuming and expensive.

- IRS officials recognize the importance of moving swiftly to implement these overdue management controls and in early April 2001, the Commissioner outlined steps (1) underway and to be taken to do so by June 30, 2001, and (2) to move CADE's Milestone 3 date to ensure that CADE's design is sufficiently defined and the integration of this design with other modernized and existing systems is effectively accomplished via, among other things, alignment with the EA and adherence to rigorous configuration management.

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Conclusions

- We believe that these steps are appropriate and prudent, and if properly implemented, should effectively address the control weaknesses discussed in this briefing.

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Recommendations for Executive Action

To the Commissioner of Internal Revenue, we reiterate our recommendation to expedite:

- completion of a sufficiently defined version of the EA to effectively guide and constrain CADE and other modernization projects, and
- implementation of other missing modernization management controls, including configuration management.

We also recommend to the Commissioner of Internal Revenue that CADE approval to exit Milestone 3 be conditioned upon IRS

- having a complete validated CADE design,
- demonstrating through the use of traceability matrices that CADE's requirements and design align with a sufficiently defined EA version, and
- implementing effective configuration management control practices.

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Agency Comments

In commenting on a draft of this briefing, IRS' CIO agreed with our conclusions and recommendations and committed to implement the modernization management control improvements discussed in this briefing by the end of June 2001.

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Comments From the Internal Revenue Service

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

COMMISSIONER

May 18, 2001

Mr. Joel C. Willemssen
Managing Director, Information
  Technology Issues
U.S. General Accounting Office
441 G Street N.W.
Washington, D.C. 20548

Dear Mr. Willemssen:

Thank you for the opportunity to respond to your draft report titled, "Results of Review of IRS' Customer Account Data Engine (CADE) Project." CADE represents the most essential and one of the most difficult aspects of the entire modernization effort. We are pleased GAO validated that:

- We are adhering to the Enterprise Life Cycle (ELC) requirements and are taking steps to assess whether the work products meet ELC process and product standards.

- We have taken steps toward developing requirements to ensure that CADE will meet our business needs.

We agree with the recommendations in the report and continue to work towards implementing key management controls to ensure CADE's effectiveness and success. We have responded to your individual recommendations below.

GAO Recommendation: "We recommend that the Commissioner of Internal Revenue expedite completion of a sufficiently defined version of the Enterprise Architecture (EA) to effectively guide and constrain CADE and other modernization projects."

Response: We recognize the EA should guide and constrain our modernization projects. In December 2000, the IRS Core Business Systems Executive Steering Committee approved the Enterprise Architecture 1.0, which we believe is sufficiently defined to guide and constrain CADE at this point of its development. We now require an enterprise architecture certification for all modernization projects prior to the milestone 3 exit documents. We are also developing a more detailed Release Architecture for 2002 and 2003 and will ensure the CADE design is consistent with the Release Architecture.

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GAO Recommendation: "We recommend that the Commissioner of Internal Revenue expedite implementation of other missing modernization management controls, including configuration management."

Response: We are practicing rigorous configuration management processes, practices, and oversight. The BSM Change Control Board approved a functional baseline of milestone 2 documents for CADE at its April 26, 2001 meeting. Any changes to the controlled functional baseline must now be submitted to the Control Board for approval using a change request with an accompanying impact analysis. Other configuration control practices and tools include:

- A request tracking system to control changes to the baseline configuration items
- A deliverables database repository which houses the official baseline documentation
  Analytical tools to assess the impact of configuration changes on the enterprise architecture and project plan baselines
  A proposed joint IRS/PRIME change control board beginning in June 2001

In early June, we will provide a report summarizing the development of our configuration management processes, the configuration items, and the configuration baselines.

GAO Recommendation: "We also recommend to the Commissioner of Internal Revenue that CADE approval to exit milestone 3 be conditioned upon IRS; (1) having a complete validated CADE design; (2) demonstrating through the use of mappings or traceability matrices that CADE's requirements and design align with a sufficiently defined version of the enterprise architecture; and (3) implementing effective configuration management control practices."

Response: We agree with your recommendations. Before approving exit of milestone 3, we will ensure CADE's logical design is complete, traceable to the current EA, and under configuration management control.

As part of the Enterprise Life Cycle processes, CADE is subject to many levels of reviews and approvals before requesting a milestone exit. To complement the existing Core Business Systems Executive Steering Committee review, we plan to conduct an in-depth senior-level review of the CADE design with the Commissioner and his executive leadership team.

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Thank you for the guidance provided by you and your staff. If you have any questions
or need additional information, please call me or John Reece, Deputy Commissioner for
Modernization & CIO, at (202) 622-6800.

Sincerely,

Charles O. Rossotti

cc: Randolph C. Hite
     James R. White

GAO Contacts and Staff Acknowledgments

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Acknowledgements

In addition to those named above, other key contributors were Bernard Anderson, Nancy DeFrancesco, Timothy Hopkins, Larry Korb, Sabine Paul, Jay Pelkofer, Sherrie Russ, Pietro Salatti, Aaron Thorne, Teresa Tucker, William Wadsworth, and Glenda Wright.

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