**Mid-range Computer Storage Resources Need
Better Administration to Ensure Effective and
Efficient Utilization and Accurate Reporting**

July 2005

Reference Number: 2005-20-098

DEPARTMENT OF THE TREASURY
WASHINGTON, D.C. 20220

INSPECTOR GENERAL
for TAX
ADMINISTRATION

July 21, 2005

MEMORANDUM FOR CHIEF INFORMATION OFFICER

FROM: Pamela J. Gardiner
Deputy Inspector General for Audit

SUBJECT: Final Audit Report - Mid-range Computer Storage Resources Need Better Administration to Ensure Effective and Efficient Utilization and Accurate Reporting (Audit # 200320016)

This report presents the results of our review of the Internal Revenue Service's (IRS) mid-range computer storage management. The overall objective of this review was to assess the effectiveness and efficiency of the IRS' mid-range computer[1] storage management practices.

In summary, the IRS requires a large and complex computer environment to process and store taxpayer, financial, and administrative data. In October 2004, the IRS had approximately 340.2 terabytes[2] of storage capacity on the mid-range computer storage area networks (SAN).[3] In Fiscal Years (FY) 2002 - 2005, the Enterprise Operations function Distributed Systems Management Branch spent about $23.2 million to purchase 156.7 terabytes ($147,797 per terabyte)[4] of mid-range computer storage hardware, software, maintenance, and other support.

Our review indicates mid-range computer SANs are not effectively managed to ensure efficient utilization of storage resources. The Distributed Systems Management Branch monitors only the amount of storage that is allocated to applications and has not

---

[1] Mid-range computers consist of file servers and related hardware, software, maintenance, and services; support enterprise application systems; and are located at the Computing Centers. IRS Computing Centers support tax processing and information management through a data processing and telecommunications infrastructure.
[2] One terabyte equals approximately 500 million pages of text.
[3] A SAN is a fiber-based, dedicated, high-speed network used to move large volumes of data between computer systems and the storage devices.
[4] The average cost per terabyte equals $23,159,747 (rounded to $23.2 million for report purposes) divided by 156.7 terabytes.

implemented the ControlCenter®[5] storage management tool or an alternative process to assess the utilization of its allocated SAN storage space. To begin addressing its lack of storage utilization management information, the Distributed Systems Management Branch is currently establishing a SAN Development Laboratory to assess storage management tools. Our analysis of allocated and utilized SAN storage determined the IRS has used approximately 35.5 percent of the allocated storage space. Therefore, the IRS could avoid spending approximately $9.9 million for additional storage capacity by improving the efficiency of its use of the current storage capacity.

In addition, duplicate and old files are not being routinely identified in the SANs because mid-range computer storage personnel do not monitor storage usage and consider it a responsibility of the application owners to identify and remove duplicate or old data. To address prevention of duplicate data storage across existing and future application systems, the Modernization and Information Technology Services organization established the Enterprise Data Management Office in November 2002. The Enterprise Data Management Office is currently working on the Enterprise Data Warehouse Strategy.

Storage capacity is not accurately, consistently, and completely reported. Distributed Systems Management Branch personnel use computer software to detect and diagram mid-range computer SAN storage and manually prepare spreadsheets to track and report storage capacity and allocations. However, comparison of the diagrams and spreadsheets identified significant differences. For example, the SAN diagrams showed 38.6 terabytes of capacity that were not listed in the spreadsheets, and the spreadsheets identified 62.0 terabytes of capacity that were not shown on the SAN diagrams. In addition, the amount of mid-range computer SAN storage reported by the Enterprise Operations function Capacity Management Branch and the Distributed Systems Management Branch are not consistent. For example, the storage volumes reported on the Capacity Management Branch web site differed from those the Distributed Systems Management Branch reported by 10.1 terabytes. The Distributed Systems Management Branch report also listed 148.6 terabytes of storage capacity for the Modernization mid-range computer systems that were not included in the Capacity Management Branch report. As a result, the inaccurately and incompletely reported web site information may have affected storage investment and resource decisions.

Finally, storage continues to be purchased although it does not comply with the IRS Enterprise Architecture[6] requirements. In FY 2004, the Enterprise Operations function purchased approximately 5.0 terabytes of noncompliant direct attached storage[7] capacity and maintenance costing $766,765 for 2 application systems the IRS expects to use indefinitely. Enterprise Operations function management did not identify any

---

[5] EMC Corporation's ControlCenter® – storage management software for use in monitoring, reporting, planning, and provisioning storage resources across tiered environments.
[6] The Enterprise Architecture defines the IRS' target business practices, the systems that enable these practices, and the technology that will support the Enterprise Architecture.
[7] Direct attached storage is storage that either exists within the system cabinet or is directly connected to one or a limited number of systems (typically two).

plans to convert the systems to networked storage within 1 year, as required by IRS procedures.

To improve mid-range computer storage management and ensure effective and efficient utilization and accurate reporting, the Chief Information Officer should ensure the implementation of the SAN Development Laboratory and the Enterprise Data Warehouse Strategy, the assessment and implementation of an appropriate storage management tool(s), and the identification and elimination of duplicate and old files. In addition, the Chief Information Officer should ensure the accuracy and completeness of storage capacity reports and the compliance of application systems' storage with the Enterprise Architecture.

Management's Response: IRS management agreed with our recommendations and has implemented several corrective actions including implementing the SAN Development Laboratory, submitting change requests to the Enterprise Architecture as required, and enforcing Enterprise Architecture waiver compliance. IRS management plans to develop an Enterprise Data Warehouse Strategy and evaluate and test an automated tool that meets the IRS' SAN management requirements. The Enterprise Operations function will issue an interim policy to restrict further creation of duplicate data within the SAN, initiate a working group to establish policy related to routine removal of duplicate and outdated files, and create a one-time plan to remove existing duplicate and outdated files. For the consolidation and transitioned Modernization systems, IRS management will ensure implementation of an automated tool that will meet the IRS' SAN management requirements. In addition, IRS management will ensure accuracy and completeness of web site storage capacity reporting and effective review of all major information technology acquisitions for Enterprise Architecture compliance. Finally, noncompliant application systems owners will be required to submit an Enterprise Architecture waiver request and a mitigation plan. The Enterprise Operations function will support and monitor the approved plan through to completion. However, IRS management disagreed with the report's cost savings estimates identified in Appendix IV based on concerns of including regular tape backup systems expenses in the cost, the database utilization figures, and the standard for storage utilization. Management's complete response to the draft report is included as Appendix V.

Office of Audit Comment: We do not agree with the IRS' response to our outcome measures included in Appendix IV. The costs savings and the methodology for calculating the savings were discussed with IRS management, and the audit report was revised based on management's comments. IRS management disagrees with including tape backup systems expenses in the basis of our calculations. The information for calculating the cost per terabyte was provided to us by IRS personnel, and they advised the figures included all components required to make a technically redundant and functional SAN.

IRS management also expressed concern about the accuracy of the database utilization figures calculated and reported in Appendix IV. The IRS database administrators and system administrators developed the computer programs to run against the databases and provided us with the utilization rates. They also validated the methodology we used

to calculate the utilization rates. During our prior discussions, IRS management commented that other database processes such as application overhead and data staging also require storage. However, they could not provide any documentation to show the impact on storage from the database processes.

Finally, IRS management took issue with the 85 percent capacity utilization goal we measured the IRS against based on our industry research. The Modernization Information Technology and Security Services Strategy and Program Plan for FY 2004 – 2005 states while the development of new technology evolves, existing operations must continue and improvements must be made to meet the needs of tax administration and demonstrate IRS commitment to improved service to taxpayers. The Plan further states the IRS will continue to respond to this challenge by continuing benchmarking efforts which allow comparison of IRS performance to that of similar efforts in private industry. Our research shows this goal is one that companies in the financial services industry and government agencies have worked toward achieving and, therefore, seems to be a reasonable goal.

Copies of this report are also being sent to the IRS managers affected by the report recommendations. Please contact me at (202) 622-6510 if you have questions or Margaret E. Begg, Assistant Inspector General for Audit (Information Systems Programs), at (202) 622-8510.

Table of Contents

Background

The Internal Revenue Service (IRS) requires a large and complex computer environment to process and store taxpayer, financial, and administrative data. A significant portion of this workload is performed in the IRS' mid-range computer environment consisting of file servers and related hardware, software, maintenance, and services. The Modernization and Information Technology Services organization is near the end of a 5-year consolidation of mid-range computer systems from multiple locations to 3 Computing Centers:[1] the Detroit Computing Center, the Enterprise Computing Center-Martinsburg, and the Enterprise Computing Center-Memphis.

The mid-range computer workloads produce large volumes of information (data) that require storage. In October 2004, the IRS had approximately 340.2 terabytes[2] of mid-range computer disk storage on the storage area networks (SAN) at the Computing Centers. The SANs are fiber-based, dedicated, high-speed networks used to move large volumes of data between computer systems and the storage devices (see Figure 1).

---

[1] IRS Computing Centers support tax processing and information management through a data processing and telecommunications infrastructure.

[2] One terabyte equals approximately 500 million pages of text.

Figure 1: SAN Network Diagram
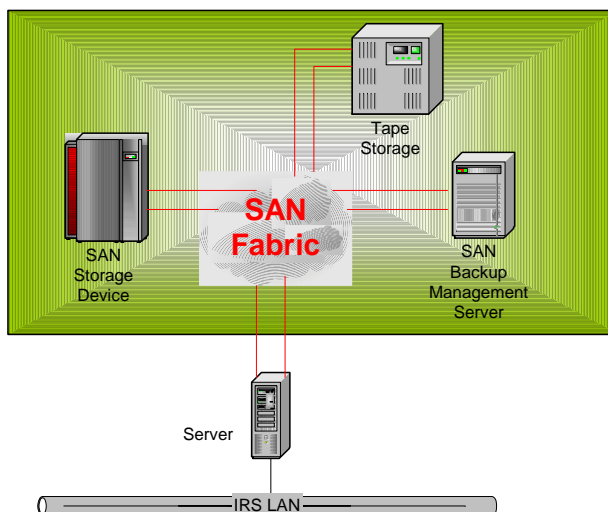
*Source: IRS Enterprise Architecture (Version 2.4, dated
August 2, 2004).*

The Enterprise Operations function Distributed Systems
Management Branch is responsible for technical and
programmatic management of all IRS mid-range computer
systems including the purchase, use, management, and
disposition of mid-range computer storage. The Enterprise
Operations function Capacity Management Branch uses
Distributed Systems Management Branch-provided
information to prepare high-level storage briefing reports for
IRS management.

In Fiscal Years (FY) 2002 - 2005, the Distributed Systems
Management Branch spent about $23.2 million to purchase
mid-range computer storage hardware, software,
maintenance, and other support for consolidated mid-range
computer systems. The IRS has also projected 20 percent
annual growth in its mid-range computer storage
environment. However, the IRS is faced with
ever-shrinking budgets. Figure 2 summarizes the actual
expenditures for mid-range computer storage.

**Figure 2: Mid-range Computer Storage Expenditures
for FYs 2002 - 2005**

Fiscal Year	Actual Expenditures (including hardware, software, maintenance, and other support)	Additional Capacity Purchased
2002	$3,128,527	84.0 terabytes
2003	$10,183,318	25.0 terabytes
2004	$6,528,536	47.7 terabytes
2005	$3,319,366	0.0 terabytes
Totals	$23,159,747	156.7 terabytes
Average cost per terabyte ($23,159,747 divided by 156.7 terabytes) = $147,797		

*Source: FYs 2002 – 2005 expenditure information obtained from IRS
management.*

This review was performed in the Enterprise Operations
function offices at the IRS National Headquarters in
New Carrollton, Maryland; the Detroit Computing Center in
Detroit, Michigan; the Enterprise Computing Center-
Martinsburg in Martinsburg, West Virginia; and the
Enterprise Computing Center-Memphis in
Memphis, Tennessee, during the period April 2004 through
February 2005. The audit was conducted in accordance
with *Government Auditing Standards*. Detailed information
on our audit objective, scope, and methodology is presented
in Appendix I. Major contributors to the report are listed in
Appendix II.

Mid-range Computer Storage Area Networks Are Not Effectively Managed to Ensure Efficient Utilization of Storage Resources

The Clinger-Cohen Act of 1996[3] states the Chief Information Officer is responsible for promoting the effective and efficient design and operation of all major information resources management processes for the executive agency. The Internal Revenue Manual states the Chief Information Officer and Director, Enterprise Operations, within the Modernization and Information Technology Services organization are responsible for ensuring the effective and efficient use of the IRS automated information processing environment.

The IRS Enterprise Architecture[4] requires computer data storage to be provided through a mix of disk, tape, and optical drives configured to provide the fastest, most available solution consistent with application cost, performance, and availability constraints. All storage will be centrally managed through a concept called storage virtualization.

Storage virtualization is the consolidation of multiple network storage devices into what appears to be a single storage unit (i.e., a virtual storage "pool") and is often used in SAN environments. It makes tasks such as archiving, backup, and recovery of data easier and faster. When an application requires additional storage capacity, the storage manager can allocate the additional storage capacity from the pool. Because the resources allocated to an application can be increased or decreased at will, there is no need to overallocate storage. Storage virtualization and SAN architecture should result in the optimal placement of files to achieve the highest performance and availability.

Our review of the mid-range computer SAN storage and storage management practices identified opportunities for more effective storage utilization.

---

[3] (Federal Acquisition Reform Act of 1996) (Information Technology Management Reform Act of 1996), Pub. L. No. 104-106, 110 Stat. 642 (codified in scattered sections of 5 U.S.C., 5 U.S.C. app., 10 U.S.C., 15 U.S.C., 16 U.S.C., 18 U.S.C., 22 U.S.C., 28 U.S.C., 29 U.S.C., 31 U.S.C., 38 U.S.C., 40 U.S.C., 41 U.S.C., 42 U.S.C., 44 U.S.C., 49 U.S.C., 50 U.S.C.).

[4] The Enterprise Architecture defines the IRS' target business practices, the systems that enable these practices, and the technology that will support the Enterprise Architecture.

Allocated storage is not being used

Storage industry research shows that data centers historically only use 15 - 60 percent of their available storage capacity, while they should have as a goal to use closer to 85 percent. In October 2004, the Distributed Systems Management Branch provided information showing the IRS had approximately 340.2 terabytes of mid-range computer SAN storage. The Distributed Systems Management Branch also reported that 285.4 terabytes (84 percent) was allocated to applications for use. However, actual utilization of allocated storage space is not currently reported and monitored.

Therefore, we worked with Detroit Computing Center, Enterprise Computing Center-Martinsburg, and Enterprise Computing Center-Memphis database administrators and system administrators to obtain information about utilization of the storage allocated to the database applications. The database administrators and system administrators wrote and manually executed scripts (i.e., small computer programs) to gather the information for each database application.

We received storage utilization information for 134.7 of the 285.4 terabytes of allocated mid-range computer SAN storage from October 25, 2004, through February 3, 2005. Due to the number of storage allocations and database tables involved and the manual effort required, IRS management did not have the resources available to provide usage information for the remaining 150.7 terabytes of storage.

- The information provided showed only 12.8 (9.5 percent) of the 134.7 terabytes of allocated SAN storage contained data.

- IRS computer storage personnel advised that the amount of data being stored is tripled to 38.4 terabytes during database application processing because the SAN creates mirror and business continuity copies of the data.

- In addition, IRS management explained the Enterprise Computing Center-Martinsburg storage allocated to the consolidated mid-range computer SAN is designated for disaster recovery. Therefore, we included the 10.1 terabytes allocated to this SAN in our

analysis. However, 0.7 terabytes of the
10.1 terabytes of storage contained data and were
included in the previous calculations regarding the
12.8 terabytes of storage. Therefore, the remaining
9.4 terabytes not containing data were added to the
38.4 terabytes to determine storage utilization.

We concluded that 47.8 (35.5 percent) of the 134.7 terabytes
are used. We then applied the industry 85 percent storage
utilization goal to the analysis and determined the IRS has
approximately 66.7 terabytes (134.7 terabytes times
85 percent minus 47.8 terabytes) of available storage
capacity.

In addition, IRS management commented that storage space
is used by application files and data files (e.g., Master File[5]
data) transferred into the SAN. Storage space also is needed
for overhead and workspace for the database application
during processing. However, IRS management could not
provide any information showing the quantity of storage
used by these files and processes.

Based on the storage utilization information provided by the
database administrators and system administrators and the
average cost of $147,797 per terabyte (see Figure 2), the
IRS could avoid spending approximately $9.9 million for
additional storage capacity by improving the efficiency of
the current storage capacity (see Appendix IV).

The IRS mid-range computer SAN storage utilization rate is
low because the Distributed Systems Management Branch
monitors only the amount of storage that is allocated to
applications and does not have a process in place to analyze
utilization of its allocated SAN storage space. Further,
Distributed Systems Management Branch management and
employees have not completely familiarized themselves
with the ControlCenter®[6] software management tool to

---

[5] The IRS database that stores various types of taxpayer account
information. This database includes individual, business, and employee
plans and exempt organizations data.
[6] EMC Corporation's ControlCenter® – storage management software
for use in monitoring, reporting, planning, and provisioning storage
resources across tiered environments.

determine its capabilities in monitoring utilization of the IRS' mid-range computer SAN storage space.

Storage industry research also shows the flexibility offered by SANs and comprehensive storage management tools can greatly benefit data centers. The storage management tools can optimally improve utilization through increasing allocation efficiency, cost-effectively controlling the amount of storage purchased, and automating manual reporting processes to assess usage trends and storage growth. The Distributed Systems Management Branch purchased storage for a SAN Development Laboratory it plans to use to determine how ControlCenter® and/or other storage management tools can help it more effectively and efficiently manage SAN storage.

Duplicate and old files are not being routinely identified in the SANs

According to storage industry experts, about one-half of stored file server data has not been accessed in 90 days or more. Therefore, the probability of files with these data being accessed or needed is very low. In addition, duplicate and obsolete files contribute unnecessarily to overall storage growth. At our request, Enterprise Computing Center-Martinsburg and Enterprise Computing Center-Memphis database administrators and system administrators created and manually ran scripts to list file characteristics (e.g., file names, file sizes, date of last file modification) for Oracle® database files on the SANs. The resulting file listings, dated October 14, 2004, through November 3, 2004, identified 4,405 files that totaled 17.9 terabytes on the SANs. Our review of the script results identified:

- Instances where file names were repeated two or more times with minor differences in the names (e.g., P1_DATA_LG_01.dbf, P1_DATA_LG_02.dbf, etc.). To determine whether files contain duplicate data, the contents would have to be compared, which is outside the scope of Modernization and Information Technology Services organization personnel's authority to access taxpayer information. A Distributed Systems Management Branch frontline manager stated the IRS has never implemented file naming conventions that would facilitate identification of duplicate files.

To address the prevention of duplicate data storage across existing and future application systems, the Modernization and Information Technology Services organization established the Enterprise Data Management Office in November 2002. The Enterprise Data Management Office is currently working on the Enterprise Data Warehouse Strategy and has brought together representatives from the Modernization and current production areas of the Modernization and Information Technology Services organization. However, Enterprise Operations function personnel stated the current effort is the third of this type to be established since 2000, and none of the previous efforts were completed.

- A total of 844 "old" files,[7] using 2.7 terabytes of storage, including 626 Electronic Fraud Detection System[8] files totaling 2.5 terabytes. See Figure 3 for the file information identified.

---

[7] Files over 90 days since last modified and temporary files over 7 days old.
[8] The Electronic Fraud Detection System is a compliance system that provides tools needed to perform, for example, prerefund detection of potentially criminal fraudulent tax returns.

Figure 3: "Old" Files Identified on the SANs

File Classification	Number of Files	File Size	Percentage of Total File Size (17.9 terabytes)
Last Modified in 2004 but Over 90 Days Old	468	1.8 terabytes	10.1
Last Modified Before 2004	292	0.7 terabytes	3.9
Temporary and Undo[9] Files Over 7 Days Old	84	0.2 terabytes	1.1
Totals	844	2.7 terabytes	15.1

Source: IRS personnel-created scripts.

Potentially duplicate and old data reside on the mid-range computer SANs because mid-range computer storage personnel do not monitor storage usage and consider it a responsibility of the application owners to identify and remove duplicate and old data.

As a result of not having an implemented process or tool to ensure the IRS is effectively and efficiently using allocated storage and identifying duplicate and old files, the IRS continues to risk purchasing additional storage it does not need.

Recommendations

To improve SAN management, the Chief Information Officer should ensure:

1. The implementation of the SAN Development Laboratory and the Enterprise Data Warehouse Strategy.

<u>Management's Response</u>: The Technical Systems Software Division implemented the SAN Development Laboratory for testing of SAN-related software to improve configuration, monitoring, and utilization reporting. The

---

[9] Files recreated after inadvertently deleting, renaming, moving, or copying a file.

Enterprise Architecture area will develop the appropriate Enterprise Data Warehouse Strategy.

2. The assessment of the capabilities of ControlCenter® or alternative tools to manage the IRS' mid-range computer storage, including monitoring the usage rates of allocated storage.

<u>Management's Response</u>: The Enterprise Operations function will assess the capabilities and ensure documented evaluation and test of an automated tool that meets the IRS' SAN management requirements for configuration, monitoring, and database utilization. However, IRS management disagreed with the report's cost savings estimates based on concerns of including regular tape backup systems expenses in the cost, the database utilization figures, and the standard for storage utilization.

<u>Office of Audit Comment</u>: We do not agree with the IRS' response to our outcome measures included in Appendix IV. The costs savings and the methodology for calculating the savings were discussed with IRS management and the audit report was revised based on management's comments. While IRS management disagreed with including tape backup systems expenses in the basis of our calculations, the information for calculating the cost per terabyte was provided to us by IRS personnel, and they advised us the figures included all components required to make a technically redundant and functional SAN.

IRS management also expressed concern about the accuracy of the database utilization figures calculated and reported in Appendix IV. The IRS database administrators and system administrators developed the computer programs to run against the databases and provided us with the utilization rates. They also validated the methodology we used to calculate the utilization rates. During our prior discussions, IRS management commented that other database processes such as application overhead and data staging also require storage. However, they could not provide any documentation to show the impact on storage from the database processes.

Finally, IRS management took issue with the 85 percent capacity utilization goal we measured the IRS against based

on our industry research. The Modernization Information Technology and Security Services Strategy and Program Plan for FY 2004 – 2005 states while the development of new technology evolves, existing operations must continue and improvements must be made to meet the needs of tax administration and demonstrate IRS commitment to improved service to taxpayers. The Plan further states the IRS will continue to respond to this challenge by continuing benchmarking efforts which allow comparison of IRS performance to that of similar efforts in private industry. Our research shows that this goal is one that companies in the financial services industry and government agencies have worked toward achieving and, therefore, seems to be a reasonable goal.

3. The implementation of ControlCenter® or an alternative tool to collect and report accurate mid-range computer storage capacity and utilization information.

Management's Response: For the consolidation and transitioned Modernization systems, the Enterprise Operations function will ensure complete implementation of an automated tool that will meet the IRS' SAN management requirements for configuration, monitoring, and database utilization.

4. The identification of files (e.g., multiple replications of the same data and files with old data warranting removal) that can be eliminated and ensure their removal.

Management's Response: The Enterprise Operations function will issue an interim policy to restrict further creation of duplicate data within the SAN, initiate a working group to establish policy related to routine removal of duplicate and outdated files, and create a one-time plan to remove existing duplicate and outdated files.

Storage Capacity Is Not Accurately, Consistently, and Completely Reported

The Government Accountability Office document *Assessing Risks and Returns: A Guide for Evaluating Federal Agencies' IT Investment Decision-making*[10] states that, despite making a huge investment in information

---

[10] Government Accountability Office/AIMD-10.1.13 (dated February 1997). IT stands for information technology.

technology, many Federal Government operations are still hampered by inaccurate data and inadequate systems. Informed management decisions can occur only if accurate, reliable, and up-to-date information is included in the decision-making process.

Distributed Systems Management Branch personnel use automated network management tools to detect and diagram storage arrays on the mid-range computer SANs. They also manually prepare spreadsheets to track and report storage capacity and allocations. As of October 2004, the spreadsheets indicated the IRS mid-range computer SAN capacity totaled approximately 340.2 terabytes. Our comparison of the SAN diagrams to the spreadsheets found the following inaccuracies:

- The SAN diagrams showed 1 storage array with 38.6 terabytes of capacity that was not listed in the spreadsheets.

- The spreadsheets identified 2 storage arrays with 62.0 terabytes of capacity that were not shown on the SAN diagrams.

These inaccuracies indicate management does not have a reliable storage capacity and allocation reporting methodology. Distributed Systems Management Branch management stated they do not use the ControlCenter® storage management software reporting tool because their limited experience with the tool had shown it to be cumbersome to use.

In addition, the amount of mid-range computer SAN (i.e., Infrastructure SAN) storage reported by the Capacity Management Branch and Distributed Systems Management Branch are not consistent. Results of our review of the storage capacity reported on the Capacity Management Branch web site differed from the amount the Distributed Systems Management Branch reported by 10.1 terabytes because the Capacity Management Branch was not timely updating its web site. Capacity Management Branch personnel indicated they receive monthly information from the Distributed Systems Management Branch and are responsible for updating the Capacity Management Branch web site with the most current information. Figure 4 shows

the storage amounts reported by the Capacity Management Branch and Distributed Systems Management Branch, respectively.

Figure 4: Mid-range Computer SAN Storage Volume Reports
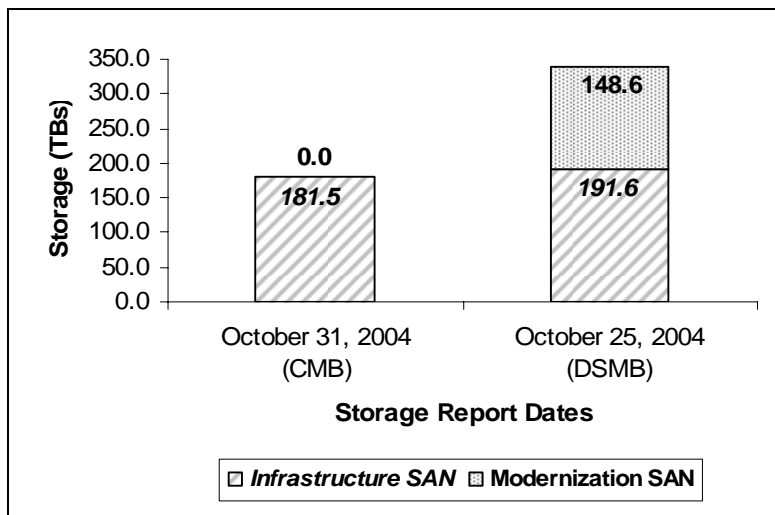
Source: Storage capacity reports located on the Capacity Management Branch (CMB) web site and Enterprise Operations function Distributed Systems Management Branch (DSMB) spreadsheets detailing storage volumes for all three Computing Centers.

In addition, the Distributed Systems Management Branch report listed 148.6 terabytes of storage capacity for the Modernization mid-range computer systems at the Detroit Computing Center and Enterprise Computing Center-Martinsburg that were not included in the Capacity Management Branch report. IRS management stated the storage information provided on the Capacity Management Branch web site is used for executive briefings. As a result, the inaccurate and incomplete information may have affected storage investment and resource decisions. Capacity Management Branch personnel stated they would be updating the mid-range computer storage capacity reported on their web site.

Without accurate and complete tracking and reporting of mid-range computer SAN storage, the IRS does not know how much storage it has and may be unable to make reliable investment and resource decisions.

Recommendations

To improve capacity and usage reporting, the Chief Information Officer should ensure:

5. The implementation of an automated SAN management tool.

<u>Management's Response</u>: For the consolidation and transitioned Modernization systems, the Enterprise Operations function will ensure implementation of ControlCenter® 5.2 (or alternative tool) to meet the IRS' SAN management requirements for configuration, monitoring, and database utilization.

6. The accuracy and completeness of Capacity Management Branch mid-range computer storage capacity reports.

<u>Management's Response</u>: The Enterprise Operations function will ensure accuracy and completeness of web site storage capacity reporting.

Some Purchased Storage Did Not Comply With the Enterprise Architecture Requirements

The Internal Revenue Manual states the Chief Information Officer and Director, Enterprise Operations, are responsible for ensuring the effective and efficient use of the IRS automated information processing environment. The IRS Enterprise Architecture requires all data to be stored on networked storage. The Enterprise Architecture prohibits application and data file storage on direct attached storage[11] and allows, during a transition period, operating system software storage on direct attached storage. To prevent compromise of the Enterprise Architecture standards, the Distributed Systems Management Branch implemented procedures limiting management approval of storage to requests that comply with the Enterprise Architecture. Requests for noncompliant storage can receive a 1-year interim approval if, for example, the requestor is planning to become compliant with the Enterprise Architecture.

The Modernization and Information Technology Services organization Enterprise Operations and End User

---

[11] Direct attached storage is storage that either exists within the system cabinet or is directly connected to one or a limited number of systems (typically two).

Equipment and Services function managers indicated they understood the Enterprise Architecture storage network and virtualization requirements apply to current and forthcoming projects. For example, Enterprise Operations function Distributed Systems Management Branch management stated all new mid-range computer consolidation projects are being configured for a SAN. Also, storage for two systems currently operating with direct attached storage is being converted to a SAN.

However, the Enterprise Operations function purchased direct attached storage capacity and maintenance for two application systems that the IRS expects to use indefinitely. Enterprise Operations function management did not identify any plans to convert the systems to networked storage within 1 year. The two systems are:

- **The Offshore Credit Card Project/Offshore Voluntary Compliance Initiative**,[12] which is a new application placed into production in March 2004. IRS management approved the direct attached storage requisition, justification, and Enterprise Architecture review without an explanation of why the storage does not comply with the Enterprise Architecture or any indication that the application system would ever be brought into compliance with the Enterprise Architecture.

  In July 2004, the IRS paid $148,635 to purchase 4.1 terabytes of storage to implement production at the Enterprise Computing Center-Martinsburg. In late 2004, the Offshore Credit Card Project/Offshore Voluntary Compliance Initiative production system was moved to the Detroit Computing Center and installed on a computer system and storage purchased in May 2003. The computer system and storage were available for the Offshore Credit Card Project/Offshore Voluntary Compliance Initiative system because they were not being used for their initial purpose.

---

[12] The Offshore Credit Card Project/Offshore Voluntary Compliance Initiative is used to monitor offshore credit card holders' tax compliance.

- **The Electronic Management System**,[13] which has operated at the Enterprise Computing Center-Memphis and Austin, Texas, Campus[14] for many years, and currently supports storage for the Modernized e-File[15] system. In January 2004, the IRS paid $618,130 for 876 gigabytes (0.9 terabytes) of direct attached storage to replace the obsolete and at-capacity storage hardware and to relocate the Austin Campus Electronic Management System storage to the Enterprise Computing Center-Martinsburg. However, the replacement storage is not Enterprise Architecture compliant, and the interim period is longer than 1 year. The approved justification stated the Electronic Management System would migrate to the Modernization platform in 2009, and an interim migration to a mid-range computer consolidation platform was not planned.

As a result of not having an effective Enterprise Architecture review and effective management of mid-range computer SAN storage, the IRS unnecessarily purchased approximately 5.0 terabytes of storage costing $766,765 (see Appendix IV). The IRS also continues to be at risk of unnecessarily purchasing direct attached storage, wasting limited resources, and compromising the Enterprise Architecture.

---

[13] The Electronic Management System is the IRS' secure electronic post office receiving, acknowledging, validating, and routing various types of tax and tax-related data.

[14] The campuses are the data processing arm of the IRS. They process paper and electronic submissions, correct errors, and forward data to the Computing Centers for analysis and posting to taxpayer accounts.

[15] First implemented in February 2004, the Modernized e-File system is an Internet web-based platform for receiving and processing electronic returns. The Modernized e-File system was developed as part of the IRS' ongoing Business Systems Modernization program.

Recommendations

To improve compliance with the Enterprise Architecture, the Chief Information Officer should ensure:

7. The effectiveness of all mid-range computer storage requisition reviews and, if Enterprise Architecture compliance is to be waived, the justification complies with IRS procedures.

Management's Response: The Enterprise Operations function will implement controls that ensure effective review of all major information technology acquisitions for Enterprise Architecture compliance.

8. Application systems owners using storage methods that are not compliant with the Enterprise Architecture (e.g., direct attached storage) develop and implement plans to convert to Enterprise Architecture-compliant network storage.

Management's Response: The Enterprise Operations function has submitted change requests to the Enterprise Architecture as required and enforces Enterprise Architecture waiver compliance during the web Request Tracking System[16] review approval process. The Enterprise Operations function will require noncompliant application system owners to submit an Enterprise Architecture waiver request and the required mitigation plan to become compliant with the Enterprise Architecture. The Enterprise Operations function will support and monitor the approved plan through to completion.

---

[16] The web Request Tracking System is a web-based application that provides users the capability to create, route, approve, and fund requisitions for goods and services.

Detailed Objective, Scope, and Methodology

The overall objective of this review was to assess the effectiveness and efficiency of the Internal Revenue Service's (IRS) mid-range computer storage management practices. To accomplish this objective, we:

I.   Compared a listing of all mid-range computer disk storage and devices containing storage for each of the three Computing Centers[1] to storage area network (SAN)[2] design diagrams and to the amount of storage reported on the Enterprise Operations function Capacity Management Branch web site. We reviewed storage volume allocations and usage reports to determine the amount of available SAN storage and the amount of SAN storage allocated to database applications. We requested database and system administrators to run scripts (i.e., small computer programs) to identify the amount of the 340.2 terabytes[3] of storage used by database applications. Management reports showed 285.4 of the 340.2 terabytes were allocated to database applications. We reviewed storage utilization information for 134.7 of the 285.4 terabytes of allocated mid-range computer SAN storage from October 25, 2004, through February 3, 2005. Due to the number of storage allocations and database tables involved and the manual effort required, IRS management did not have the resources available to provide utilization information for the remaining 150.7 terabytes of storage.

We interviewed database and system administrators and Enterprise Operations function Distributed Systems Management Branch personnel to identify current needs, projected budget needs, and actual expenditures for mid-range computer storage for Fiscal Years 2002 - 2005. We also researched storage industry information on storage utilization.

II.   Interviewed Distributed Systems Management Branch personnel responsible for overseeing the mid-range computer storage Enterprise Architecture,[4] personnel from the Enterprise Operations function Distributed Systems Software Branch responsible for managing mid-range computer hardware and software, End User Equipment and Services function personnel, and other Enterprise Operations function personnel to determine whether policies and procedures have been developed for reviewing changes to the Enterprise Architecture. We also identified and reviewed any information technology

---

[1] IRS Computing Centers support tax processing and information management through a data processing and telecommunications infrastructure.
[2] A SAN is a fiber-based, dedicated, high-speed network used to move large volumes of data between the computer systems and the storage devices.
[3] One terabyte equals approximately 500 million pages of text.
[4] The Enterprise Architecture defines the IRS' target business practices, the systems that enable these practices, and the technology that will support the Enterprise Architecture.

projects using direct attached storage[5] to determine the cost of the storage and whether the storage was properly reviewed, approved, and justified.

III.   Reviewed the IRS' as-built-architecture documentation and interviewed mid-range computer storage management at each Computing Center to identify potential duplication of files. We also interviewed mid-range computer storage, system, and database administrators at each Computing Center to identify potential data duplication actions. At our request, the database and system administrators generated and ran scripts providing the characteristics (e.g., file names, file sizes, date of last file modification) of files in the SAN and storage array capacity, table space allocation, and usage data.

---

[5] Direct attached storage is storage that either exists within the system cabinet or is directly connected to one or a limited number of systems (typically two).

**Mid-range Computer Storage Resources Need Better Administration
to Ensure Effective and Efficient Utilization and Accurate Reporting**

Appendix II

Major Contributors to This Report

Margaret E. Begg, Assistant Inspector General for Audit (Information Systems Programs)
Gary Hinkle, Director
Danny Verneuille, Audit Manager
Mark Carder, Lead Auditor
James Douglas, Senior Auditor
Frank Greene, Senior Auditor
Kim McManis, Auditor

Report Distribution List

Commissioner C
Office of the Commissioner – Attn: Chief of Staff C
Deputy Commissioner for Operations Support OS
Associate Chief Information Officer, Business Systems Modernization OS:CIO:B
Associate Chief Information Officer, Information Technology Services OS:CIO:I
Director, Stakeholder Management OS:CIO:SM
Director, Business Systems Development OS:CIO:I:B
Director, End User Equipment and Services OS:CIO:I:EU
Director, Enterprise Operations OS:CIO:I:EO
Chief Counsel CC
National Taxpayer Advocate TA
Director, Office of Legislative Affairs CL:LA
Director, Office of Program Evaluation and Risk Analysis RAS:O
Office of Management Controls OS:CFO:AR:M
Audit Liaisons:
      Deputy Commissioner for Operations Support OS
      Manager, Program Oversight Office OS:CIO:SM:PO

Outcome Measures

This appendix presents detailed information on the measurable impact that our recommended corrective actions will have on tax administration. These benefits will be incorporated into our Semiannual Report to the Congress.

Type and Value of Outcome Measure:

- Cost Savings, Funds Put to Better Use – Potential $9,858,060 (see page 4).

Methodology Used to Measure the Reported Benefit:

We worked with Internal Revenue Service (IRS) Computing Center[1] database administrators and system administrators to obtain storage array capacity, table space allocation, and usage data. The IRS reported 285.4 of approximately 340.2 terabytes[2] were allocated to databases. We received storage utilization information from October 25, 2004, through February 3, 2005, for only 134.7 of the 285.4 terabytes of allocated mid-range computer Storage Area Network (SAN)[3] storage. The information provided showed only 12.8 (9.5 percent) of the 134.7 terabytes of allocated SAN storage contained data. IRS computer storage personnel advised that the amount of storage in use would be tripled to 38.4 terabytes during database application processing because the SAN creates mirror and business continuity copies of the data. In addition, 10.1 terabytes (0.7 terabytes included in 12.8 terabytes that contained data plus 9.4 terabytes that did not contain data) of the Enterprise Computing Center-Martinsburg storage allocated to the consolidated mid-range computer SAN is designated for disaster recovery. Therefore, we included the 9.4 terabytes of allocated storage not containing data in our assessment of utilized storage and concluded that 47.8 (35.5 percent) of the 134.7 terabytes are used. We then applied the industry goal of 85 percent utilization of storage to the analysis and determined the IRS has 66.7 terabytes of available storage capacity. Table 1 shows how we estimated the available storage capacity. Due to the number of storage allocations and database tables involved and the manual effort required, IRS management did not have the resources available to provide utilization information for the remaining 150.7 terabytes of storage.

In addition, IRS management commented that storage space is used by application files and data files (e.g., Master File[4] data) transferred into the SAN. Storage space also is needed for overhead

---

[1] IRS Computing Centers support tax processing and information management through a data processing and telecommunications infrastructure.

[2] One terabyte equals approximately 500 million pages of text.

[3] A SAN is a fiber-based, dedicated, high-speed network used to move large volumes of data between the computer systems and the storage devices.

[4] The IRS database that stores various types of taxpayer account information. This database includes individual, business, and employee plans and exempt organizations data.

and workspace for the database application during processing. However, IRS management could not provide any information showing the quantity of storage used by these files and processes.

Table 1: Calculation of Available Mid-range Computer Storage Capacity (in terabytes)

	Total Capacity	85% Capacity Usage Goal (i.e., Total Capacity column times 85%)	Capacity Used	Available Storage Capacity (i.e., 85% Capacity Usage Goal column minus Capacity Used column)
Capacity Utilized (where the IRS provided utilization information)	134.7 terabytes	114.5 terabytes	47.8 terabytes	66.7 terabytes
Average cost per terabyte of storage purchased in Fiscal Years 2002 - 2005 (including hardware, software, maintenance, and other support)				= $147,797
Potential savings by improving the efficiency of current storage utilization (66.7 terabytes times $147,797 per terabyte)				= $9,858,060

Source: IRS storage management reports and personnel-created scripts.

Type and Value of Outcome Measure:

- Inefficient Use of Resources – Actual; $766,765 (see page 14).

Methodology Used to Measure the Reported Benefit:

We identified applications and systems that use direct attached storage[5] and reviewed requisition, justification, and delivery order documents for direct attached storage purchased for these applications and systems in Fiscal Years 2003 and 2004. We determined the IRS purchased direct attached storage for the Offshore Credit Card Project/Offshore Voluntary Compliance Initiative[6] and the Electronic Management System,[7] but the approved justifications did not comply with IRS guidelines. In addition, the purchases may not have been necessary given the storage utilization rate of only 35.5 percent of the 134.7 terabytes of SAN storage analyzed. Table 2 shows the amount of direct attached storage purchased and its cost.

---

[5] Direct attached storage is storage that either exists within the system cabinet or is directly connected to one or a limited number of systems (typically two).

[6] The Offshore Credit Card Project/Offshore Voluntary Compliance Initiative is used to monitor offshore credit card holders' tax compliance.

[7] The Electronic Management System is the IRS' secure electronic post office receiving, acknowledging, validating, and routing various types of tax and tax-related data.

Table 2: Direct Attached Storage Purchases and Costs

IRS System	Terabytes of Direct Attached Storage Purchased	Direct Attached Storage Cost
Offshore Credit Card Project/Offshore Voluntary Compliance Initiative	4.1 terabytes	$148,635
Electronic Management System (costs include racks, servers, standby power supply, switches, maintenance, and other items)	0.9 terabytes	$618,130
Totals	5.0 terabytes	$766,765

Source: IRS purchase requisition information.

**Mid-range Computer Storage Resources Need Better Administration
to Ensure Effective and Efficient Utilization and Accurate Reporting**

Appendix V

Management's Response to the Draft Report

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

RECEIVED
JUN 2 4 2005

CHIEF INFORMATION OFFICER

June 24, 2005

MEMORANDUM FOR DEPUTY INSPECTOR GENERAL FOR AUDIT

FROM: W. Todd Grams
               Chief Information Officer

SUBJECT: Management Response to Draft Audit Report –
               Mid-range Computer Storage Resources Need
               Better Administration to Ensure Effective and
               Efficient Utilization and Accurate Reporting
               (Audit #200320016) **(ECMS # 0505-6CRMXYYC)**

Thank you for the opportunity to review the subject report and respond to the
recommendations. We agree with the recommendations in the report and are
committed to the corrective actions we have developed to address each issue.

Although we concur with the reports' recommendations, we are unable to concur with
the reports' cost savings estimates as identified in the outcome measures in Appendix
IV. Our specific concerns are presented below:

- We disagree with including regular tape backup systems expenses in the basis of
  your calculations. Although IRS Tier II storage area networks (SAN) utilize tape
  media virtualization for one project, some of the tape backup system costs (over
  four million dollars included in "other support" expenses within the report's
  calculations) are utilized to meet regular systems tape backup required by the
  Internal Revenue Manual (IRM). The IRS proposes four million dollars be
  deducted from SAN related costs per terabyte (TB) calculations.

- The IRS has a concern about the accuracy of the database utilization figures. As
  an example, results of the Treasury Inspector General for Tax Administration
  (TIGTA) provided script indicated the Security Audit & Analysis System (SAAS)
  was only utilizing 23 percent of the project's allocated 10 TB of Direct Attached
  Storage Device (DASD) in January 2005. However, the SAAS project
  encountered failed processes due to lack of temp and rollback space, prompting
  a request for an additional two TB of DASD resources in March 2005. The SAAS
  project's additional two terabyte request was technically analyzed and approved.
  The discrepancy between the January's reported utilization and the actual usage
  indicates a possible flaw in the usage data gathering techniques used by the
  TIGTA.

2

- As far as a standard for DASD storage utilization, the IRS has performed research and systems analysis related to the IRS systems configuration and usage. The Forrester Group and the EMC Corporation have stated that data centers the size of the IRS' would not be able to attain 85 percent without system downtime. Although some of our estimates show we could be at 65 percent on some systems, the ControlCenter® tool will help us determine the exact utilization rate for all of our Tier II systems. Based on these findings, the IRS asked TIGTA to provide the resources used to determine where TIGTA found the 85 percent capacity utilization that they are measuring us against. TIGTA provided three Internet articles:

    o One article stated that most data centers were between 15 and 30 percent and that if correct tools were used they could get up to 85 percent. The article did not state that any organization was currently at 85 percent.

    o A second article stated that if the ControlCenter® tool was used, it would be possible to get up to 85 percent. The IRS is currently testing the ControlCenter® tool.

    o The third article stated that these tools are in their infancy and that it will take time to get up to 85 percent.

    Based on the industry information that TIGTA reviewed, IRS disagrees with holding the agency to 85 percent at this time. The information TIGTA reviewed did not show any private corporation or government agency (with the IRS type of environment) that reached 85 percent. As we continue to test the ControlCenter® tool to determine if it will work in the IRS environment we will share the results with TIGTA. The IRS would like to build the storage capacity utilization to its full potential within the IRS environment, but we cannot afford to be a test case for reaching an 85 percent capacity utilization rate (in our environment) without seeing evidence that this would be a feasible and cost-effective goal.

Hence, the IRS feels that further analysis is required for accurate capacity utilization percentages. The IRS would like TIGTA to recalculate the proposed cost savings identified in the "outcome measures" (Appendix IV) based on the above issues.

If you have questions, please call me at (202) 622-6800, or members of your staff may contact Judith Mills, Director, Program Oversight Office, at (202) 283-4915.

Attachment

**Draft Report – Mid-range Computer Storage Resources Need Better Administration
to Ensure Effective and Efficient Utilization and Accurate Reporting --
Audit # 200320016**

RECOMMENDATION #1: To improve storage area networks (SAN) management, the
Chief Information Officer (CIO) should ensure the implementation of the SAN
Development Laboratory and the Enterprise Data Warehouse (EDW) strategy.

CORRECTIVE ACTION #1a: Technical Systems Software Division implemented the
SAN Development Laboratory for testing of storage area networks (SAN) related
software for configuration, monitoring and utilization reporting to improve SAN
management.

IMPLEMENTATION DATE: Completed May 1, 2005

RESPONSIBLE OFFICIAL: Director, Technical Systems Software Division
OS:CIO:I:EO:SS

CORRECTIVE ACTION MONITORING PLAN: N/A

CORRECTIVE ACTION #1b: Enterprise Architecture (EA) area will develop the
appropriate Enterprise Data Warehouse (EDW) strategy.

IMPLEMENTATION DATE: April 1, 2006

RESPONSIBLE OFFICIAL: Director, Enterprise Architecture OS:CIO:B:SI:EA

CORRECTIVE ACTION MONITORING PLAN: Our Data Warehouse Strategy will
address issues with data duplication. Since the cancellation of the Custodial Accounting
Project (CAP), Enterprise Data Management Office (EDMO) has been working with
Business Systems Development (BSD), Enterprise Operations Services (EOS), and
business users to build out an enterprise data warehousing capability. An effort has been
mounted to consolidate multiple projects into an enterprise solution that will produce one
corporate data warehouse that is the source of multiple data marts to support individual
business units' analytical needs

In accordance with our new set of modernization operating principles, our approach to
this development will be based on a rapid application development and iterative
development. EDMO will work with BSD to define small segments of work that will
enhance the existing state of the data warehouse, improving its performance while
moving the data model towards the enterprise data model. This strategy will result in
some segment of data becoming ready for use in the near term with new data coming on
line as it becomes available. BSD has asked the business unit to determine which data
is needed and in what order. We are aiming to keep the iterations to small (6-8 weeks)
segments. After each segment the team will assess results and plan the next segment of
work.

Timing for execution of the EDW development will be determined as part of the planning initiative the IRS has begun to readdress its IT Modernization Strategy and Approach. We have committed to GAO and Congress that such a plan will be completed by the end of this fiscal year (FY2005). The development of an EDW to support enhanced case selection for exam and collections has been determined to be a key IT modernization goal. To fully determine the EDW development plan, we will want to execute a cycle of the rapid application development approach to gain experience and help size the overall effort. Given that, the IRS will be able to provide detail on the development schedule for the EDW by the end of March 2006.

RECOMMENDATION #2: To improve SAN management, the CIO should ensure the assessment of the capabilities of Control Center or alternative tools to manage the IRS' mid-range computer storage, including monitoring the usage rates of allocated storage.

CORRECTIVE ACTION: Enterprise Operations Services (EOS) will assess the capabilities and ensure documented evaluation and test of an automated tool that meets IRS's SAN management requirements for configuration, monitoring, and database utilization.

IMPLEMENTATION DATE: October 1, 2005

RESPONSIBLE OFFICIAL: Director, Technical Systems Software Division
OS:CIO:I:EO:SS

CORRECTIVE ACTION MONITORING PLAN: EOS' Technical Systems Software Division (TSSD) monitors progress of the corrective action milestones on a biweekly basis. A senior IRS SAN technician is assigned to this specific corrective action and progress will be monitored at the branch level with biweekly updates provided to the division (TSSD).

Draft Report – Mid-range Computer Storage Resources Need Better Administration
to Ensure Effective and Efficient Utilization and Accurate Reporting --
Audit # 200320016

RECOMMENDATION #3: To improve SAN management, the CIO should ensure the
implementation of Control Center or an alternative tool to collect and report accurate mid-
range computer storage capacity and utilization information.

CORRECTIVE ACTION 3a: For consolidation systems, Enterprise Operations will
ensure complete implementation of an automated tool that will be configured to meet
IRS's SAN management requirements for SAN configuration, monitoring, and database
utilization. The implementation dates are contingent upon the results of corrective action
number two indicating that Control Center will meet our requirements. If another tool is
required, then this implementation date will need to be reevaluated for an extension.

IMPLEMENTATION DATE: May 1, 2006

RESPONSIBLE OFFICIAL: Director, Technical Systems Software Division
OS:CIO:I:EO:SS

CORRECTIVE ACTION MONITORING PLAN: EOS Technical Systems Software
Division monitors progress of corrective action milestones on a biweekly basis. At the
completion of recommendation number two, a project lead will be assigned to implement
the specific tool(s) across all managed Tier II platforms. Progress will be monitored at
the branch level with biweekly updates provided to the division (TSSD).

CORRECTIVE ACTION 3b: For transitioned Modernization systems, Enterprise
Operations Services will ensure complete implementation of an automated tool that will
be configured to meet IRS's SAN management requirements for SAN configuration,
monitoring, and database utilization. The implementation dates are contingent upon the
results of corrective action number two indicating that Control Center will meet our
requirements. If another tool is required then these implementation dates will need to be
reevaluated for an extension.

IMPLEMENTATION DATE: May 1, 2007

RESPONSIBLE OFFICIAL: Director, Technical Systems Software Division
OS:CIO:I:EO:SS

CORRECTIVE ACTION MONITORING PLAN: EOS Technical Systems Software
Division monitors progress of corrective action milestones on a biweekly basis. At the
completion of recommendation number two, a project lead will be assigned to implement
the specific tool(s) across all managed a Tier II platforms. Progress will be monitored at
the branch level with biweekly updates provided to the division (TSSD).

Draft Report – Mid-range Computer Storage Resources Need Better Administration
to Ensure Effective and Efficient Utilization and Accurate Reporting --
Audit # 200320016

RECOMMENDATION #4: To improve SAN management, the CIO should ensure the
identification of files (e.g., multiple replications of the same data and files with old data
warranting removal) that can be eliminated and ensure their removal.

CORRECTIVE ACTION: Enterprise Operations Services will issue an interim policy to
restrict any further creation of duplicate data within the SAN; will initiate a working group
to establish policy related to routine removal of duplicate and outdated files; and will
create a one-time plan to remove existing duplicate and outdated files within the SAN.

IMPLEMENTATION DATE: June 1, 2006

RESPONSIBLE OFFICIAL: Director, Technical Systems Software Division
                                            OS:CIO:I:EO:SS

CORRECTIVE ACTION MONITORING PLAN: EOS Technical Systems Software
Division monitors progress of prepared corrective action milestones on a biweekly basis.

RECOMMENDATION #5: To improve capacity and usage reporting, the CIO should
ensure the implementation of an automated SAN management tool.

CORRECTIVE ACTION 5a: For consolidation systems, Enterprise Operations Services
will ensure implementation of Control Center 5.2 (or alternative tool) to meet IRS's SAN
management requirements for SAN configuration, monitoring, and database utilization.
The implementation dates are contingent upon the results of corrective action number
two indicating that Control Center will meet our requirements. If another tool is required,
then these implementation dates will need to be reevaluated and they likely will change.

IMPLEMENTATION DATE: May 1, 2006

RESPONSIBLE OFFICIAL: Director, Technical Systems Software Division
                                            OS:CIO:I:EO:SS

CORRECTIVE ACTION MONITORING PLAN: EOS Technical Systems Software
Division monitors progress of corrective action milestones on a biweekly basis. At the
completion of recommendation number two, a project lead will be assigned to implement
the specific tool(s) across all managed Tier II platforms. Progress will be monitored at
the branch level with biweekly updates provided to the division (TSSD).

Draft Report – Mid-range Computer Storage Resources Need Better Administration
to Ensure Effective and Efficient Utilization and Accurate Reporting --
Audit # 200320016

CORRECTIVE ACTION 5b: For transitioned Modernization systems, Enterprise
Operations will ensure implementation of Control Center 5.2 (or alternative tool) to meet
IRS's SAN management requirements for SAN configuration, monitoring, and database
utilization. The implementation dates are contingent upon the results of corrective action
number two indicating that Control Center will meet our requirements. If another tool is
required, then these implementation dates will need to be reevaluated and they likely will
change.

IMPLEMENTATION DATE: May 1, 2007

RESPONSIBLE OFFICIAL: Director, Technical Systems Software Division
OS:CIO:I:EO:SS

CORRECTIVE ACTION MONITORING PLAN: EOS Technical Systems Software
Division monitors progress of corrective action milestones on a biweekly basis. At the
completion of recommendation number two, a project lead will be assigned to implement
the specific tool(s) across all managed Tier II platforms. Progress will be monitored at
the branch level with biweekly updates provided to the division (TSSD).

RECOMMENDATION #6: To improve capacity and usage reporting, the CIO should
ensure the accuracy and completeness of the Capacity Management Branch (CMB) mid-
range computer storage capacity reports.

CORRECTIVE ACTION: Enterprise Operations Services will ensure accuracy and
completeness of web-site mid-range computer storage capacity reporting. The
implementation dates are contingent upon the results of corrective action number two
indicating that Control Center will meet our requirements. If another tool is required, then
the implementation date will need to be reevaluated for extension.

IMPLEMENTATION DATE: May 1, 2006

RESPONSIBLE OFFICIAL: Director, Technical Systems Software Division
OS:CIO:I:EO:SS

CORRECTIVE ACTION MONITORING PLAN: EOS Technical Systems Software
Division monitors progress of corrective action milestones on a biweekly basis.

Draft Report – Mid-range Computer Storage Resources Need Better Administration
to Ensure Effective and Efficient Utilization and Accurate Reporting --
Audit # 200320016

_____

RECOMMENDATION #7: To improve compliance with the Enterprise Architecture (EA),
the CIO should ensure the effectiveness of all mid-range computer storage requisition
reviews and, if EA compliance is to be waived, the justification complies with IRS
procedures.

CORRECTIVE ACTION: Enterprise Operations Services will implement controls that
ensure effective review of all major information technology (IT) acquisitions for
compliance with the Enterprise Architecture (EA).

IMPLEMENTATION DATE: September 1, 2005

RESPONSIBLE OFFICIAL: Director, Technical Systems Software Division
OS:CIO:I:EO:SS

CORRECTIVE ACTION MONITORING PLAN: EOS Technical Systems Software
Division monitors progress of corrective action milestones on a biweekly basis.

RECOMMENDATION #8: To improve compliance with the EA, the CIO should ensure
application systems' owners using storage methods that are not compliant with the EA
(e.g., Direct Attached Storage [DAS]) develop and implement plans to convert to EA
compliant network storage.

CORRECTIVE ACTION #8a: Enterprise Operations Services has submitted change
requests specific to Tier II SAN environment requirements to the Enterprise Architecture
(EA) as required. A process is in place to ensure the timely submission of change
requests to EA. (To date 19 change requests have been submitted to EA.)

IMPLEMENTATION DATE: Completed May 1, 2005

RESPONSIBLE OFFICIAL: Director, Technical Systems Software Division
OS:CIO:I:EO:SS

CORRECTIVE ACTION MONITORING PLAN: N/A

CORRECTIVE ACTION #8b: Enterprise Operations Services enforces Enterprise
Architecture (EA) waiver compliance during the webRTS Tier II review approval process.
A process is in place to enforce EA waiver compliance during the webRTS Tier II review
approval process.

IMPLEMENTATION DATE: Completed May 1, 2005

Draft Report – Mid-range Computer Storage Resources Need Better Administration
to Ensure Effective and Efficient Utilization and Accurate Reporting --
Audit # 200320016

RESPONSIBLE OFFICIAL: Director, Technical Systems Software Division
OS:CIO:I:EO:SS

CORRECTIVE ACTION MONITORING PLAN: N/A

CORRECTIVE ACTION #8c: Enterprise Operations Services will require non-compliant
application system owners to submit an Enterprise Architecture (EA) waiver request and
submit the required mitigation plan to become compliant with the EA.   Enterprise
Operations will support and monitor the approved plan through to completion.

IMPLEMENTATION DATE: December 1, 2005

RESPONSIBLE OFFICIAL: Director, Technical Systems Software Division
OS:CIO:I:EO:SS

CORRECTIVE ACTION MONITORING PLAN: EOS Technical Systems Software
Division monitors progress of corrective action milestones on a biweekly basis.