



U.S. GOVERNMENT PRINTING OFFICE
OFFICE OF INSPECTOR GENERAL

ASSESSMENT REPORT

10-05

FEDERAL DIGITAL SYSTEM (FDSYS) INDEPENDENT VERIFICATION AND VALIDATION – TENTH QUARTER REPORT ON RISK MANAGEMENT, ISSUES, AND TRACEABILITY

March 24, 2010

**Date**

March 24, 2010

To

Chief Information Officer

From

Assistant Inspector General for Audits and Inspections

Subject**Federal Digital System (FDsys) Independent Verification and Validation (IV&V) – Tenth Quarter Report on Risk Management, Issues, and Traceability
Report Number 10-05**

The Government Printing Office (GPO) Office of Inspector General (OIG) is conducting independent verification and validation (IV&V) of GPO's Federal Digital System (FDsys)¹ implementation. The OIG contracted with American Systems² to conduct IV&V for the public release of FDsys.³ As part of its contract with the OIG, American Systems is assessing the state of program management, technical and testing plans and other efforts related to the rollout of Release 1 (formerly R1C2).

American Systems is required by the contract to issue to the OIG a quarterly Risk Management, Issues, and Traceability Report, providing observations and recommendations on the program's technical, schedule, and cost risks as well as requirements traceability of those risks and the effectiveness of the program management processes in controlling risk avoidance. Additionally, at the end of each FDsys release phase, American Systems is required to issue a release phase summary program management report

¹The FDsys program is a multimillion dollar effort that GPO is funding and managing to modernize the GPO information collection, processing, and dissemination capabilities it performs for the three branches of the Federal Government.

²American Systems, located in Chantilly, Virginia, is a large information technology company with significant experience in the realm of IV&V for Federal civilian and Defense agencies, including the Department of State, the Navy, and the U.S. Agency for International Development.

³American Systems IV&V methodology is referenced to the framework established by the Institute of Electrical and Electronic Engineers (IEEE) Standard 1012-2004, the IEEE Standard for Software Verification and Validation.

that addresses delivery of the technical baseline per the FDsys Master Program Schedule and the risks that affect the schedule's critical path to the next phase.

The enclosed report is American Systems' quarterly report for the period October 1, 2009 to December 31, 2009. During this quarter, American Systems identified a number of technical risks associated with FDsys development practices, system engineering, continuous operations (COOP), existing Program Trouble Reports (PTRs), and the FDsys test program. American Systems also identified schedule and cost risks associated with these technical risks. Section 4 of the report contains six recommendations designed to mitigate these risks and strengthen overall management of the FDsys program.

One recommendation is resolved and will remain open until corrective actions have been taken. Five recommendations are unresolved. Of those five, we are closing two recommendations upon issuance of this report. Three unresolved recommendations will remain open. The rationale behind our decision to close two recommendations and maintain four recommendations in open status is provided in the "Evaluation of Management's Response" section that follows each recommendation in Section 4 of the report. The status of each recommendation upon issuance of this report is included in Appendix B. The final report distribution is in Appendix C.

If you have questions concerning this report or the IV&V process, please contact Mr. Brent Melson, Deputy Assistant Inspector General for Audits and Inspections at (202) 512-2037, or me at (202) 512-2009.



Kevin J. Carson
Assistant Inspector General for Audits and Inspections

Enclosure

cc:
Deputy Public Printer
Chief Acquisition Officer
Chief Management Officer
Chief Technology Officer

IV&V RISK MANAGEMENT, ISSUES, AND TRACEABILITY REPORT	
TO:	Brent Melson
FROM:	David Harold
IV&V OF:	Quarterly Report (Draft – Document Number 02-010)
SUBJECT:	October 01, 2009 – December 31, 2009 Quarterly Report
DATE:	January 14, 2010
CC:	Dan Rose, Jon Valett, John Best, Shawn O'Rourke

Background:

This report presents the critical technical, schedule, and cost risks identified for the Government Printing Office (GPO) Federal Digital System (FDsys) Program. Specifically, it provides a high-level overview of the key risks and issues that Independent Verification & Validation (IV&V) has identified during the quarter ending 31 December 2009.

Since 30 September 2009, the FDsys Program Management Office (PMO) completed the deployment of several post-Release 1 production builds, held a Program Review, provided information to the Office of the Inspector General (OIG) in response to a number of open recommendations from previous IV&V reports, and prepared/updated FDsys technical documentation. The production builds are summarized below along with the other events that occurred during the first quarter of Fiscal Year (FY) 2009.

References:

- a. *FDsys FY'09 Review and Program Update*, dated December 9, 2009
- b. *FDsys System Design Document, Volume LVIII: COOP*, dated October 2009
- c. *GPO's FDsys: System Releases and Capabilities*, Version 5.0, dated December 19, 2007
- d. *IV&V Quarterly Risk Report June 2009 – Draft*, dated 10 July 2009
- e. *IV&V Quarterly Risk Report September 2009 - Final*, dated 21 October 2009

Summary:

Release 1.6.2.376:

- The deployment of Production build 1.6.2.376 occurred on Friday, 30 October 2009. This Release addressed seven (7) software Program Tracking Reports (PTRs), most notably a Severity 1 – PTRSW 45 (no access to workflow data) and a Severity 2 – PTRSW 345 (replace Federal Register packages with digitally signed versions) discovered by the test team during testing. The build also addressed a Severity 1 System PTR (SYSPTR) 2503 (registry points to wrong database). No additional Collections were included in this Release.

Release 1.7.0.380:

- The deployment of Production build 1.7.0.380 occurred on Friday, 18 December 2009. Three (3) new collections were targeted for this build: Code of Federal Regulations (CFR), Public Papers of the President of the United States (PPP), and Precedents of the House of Representatives (HPREC). This build also deploys a new Metadata Editor Tool (i.e., XML Metadata Editor (XME) Tool), and resolves a total of forty-six (46) PTRs. During the Configuration Control Board (CCB) meeting that occurred prior to this deployment, the FDSys Program Management Office (PMO) stated that the deployed system would require an immediate update (i.e., tentatively planned for Wednesday, 23 December 2009) to correct a problem with the new processor for the CFR Collection.

Release 1.7.0.381:

- The deployment of Production build 1.7.0.381 occurred on Wednesday, 23 December 2009. This build contained the “hotfix” (software patch) that was needed to fix a Documentum bug/error that was found. The original software patch that was provided did not work and had to be backed out. As excerpted from PTRSYS #376 (that was created for this problem): *“We have discovered a memory segmentation fault periodically in the Dev and Test environment log files. We have also seen a couple of them in Feb and April 2009 in the Docbase before the refactor. EMC Documentum has a hotfix to resolve this issue and it needs to be applied to the Documentum servers.”*

This build also contained two (2) PTR fixes for parser errors. These errors were found in the CFR collection. Specifically (from PTRSW 2680): “File names for CFR Title 1 granules for 2009 have 2005 in the granule accessid and file names. This could be causing issues throughout the system, including why CFR Title 1 package level does not display the Document in Context section. This is probably specific to Cover-Only packages.”

FDsys Program Review Meeting:

- The FDsys PMO conducted a Program Review on 9 December 2009 (*see Attachment*). During this meeting, the PMO discussed the Program's accomplishments since January 2009, and also briefly described the plans for FY 2010. Key points from the meeting are as follows:
 - The next Production build for FDsys Release 1 will contain three (3) more Collections: CFR, PPP, and HPREC. After this deployment, FDsys will contain twenty-five (25) of the fifty-five (55) Collections originally targeted for Release 1.
 - Three (3) major efforts are planned for FY 2010: Sunset GPO Access (i.e., complete the migration of all Collections to FDsys), Stand-up the Continuity of Operations (COOP) instance, and implement Congressional Submission. It should be noted that the PMO (in April 2009) had previously planned to complete these efforts in FY 2009.
 - The PMO stated that only forty-two (42) Collections will be migrated to FDsys instead of the original fifty-five (55) Collections. The PMO indicated that they were looking into ways to combine some of the other Collections but the detailed analysis had not yet been completed.
 - The PMO estimates that contractor support for FDsys development cost \$6.3 million in FY 2009. The PMO has \$7.8 million for development support in FY 2010. By the end of FY 2010, therefore, the total costs for FDsys contractor support will be approximately \$42 million. (NOTE: This total cost is unaudited and is provided to IV&V by the GPO Office of Finance and Administration.)
 - Since January 2009, the PMO has deployed twenty-five (25) Production builds to update the FDsys design, deploy additional Collections, and correct Program Tracking Reports (PTRs). Although not mentioned during the meeting, this large number of deployments over a ten month period reflects the obvious fact that the originally deployed system contained numerous deficiencies.
 - An on-going issue is an indexing problem within the FAST search product. As the content database grows (i.e., with the addition of Collections), changes are required to enable FAST to handle the ever growing number of records. With the next deployment in December, the FDsys database will approach the current threshold (2.5 million records). Mr. Wash expressed concern over this issue and requested further information from the FDsys development team.

- The current projected COOP instance “go-live” date is July 2010 assuming all hardware was ordered by 16 December 2009. However, some of the hardware is still awaiting approval. The COOP design documentation is under review and the PMO plans to hold a formal design review meeting sometime in the future. While most of the hardware has been ordered, the required network hardware had not been ordered as of 9 December 2009.

PMO Responses to OIG:

- In December, the PMO responded to an OIG request for FDsys documentation and information needed to address several open recommendations from previous IV&V Task Reports. The PMO addressed two of the items: an updated Configuration Management Plan and a Requirements Management Plan. However, for many of the open items, the PMO’s responses were non-specific, that is, the following type of information was provided: “*the FDsys Program is working on developing or updating a document or process for Release 2.*” Thus, the recommendations remain open because the FDsys Program has performed little to no analysis, planning, design, or development work for Release 2; with the majority of work centered on fixing issues/problems with the Production (Post-Release 1).

FDsys Technical Documentation:

- The PMO produced technical documentation to support FDsys development. Data Management Documents (DMDs) for three (3) additional Collections, a System Design Document (SDD) for the XML Metadata Editor (XME) Tool, and an SDD for the COOP were developed. The PMO also updated both the Configuration Management Plan and FDsys Requirements Management Plan (Draft).

Key IV&V Efforts:

In November 2009, IV&V performed a review of the overall state of the GPO FDsys Program. The details of this review are provided in this report’s Attachment. Its results form the basis of the risks and recommendations discussed below.

At the PMO’s request, IV&V also provided comments on 20 November 2009, against the *FDsys System Design Document, Volume LVIII: COOP*, dated October 2009 (*Reference b.*).

1. Technical Risks Identified

During the last quarter, IV&V identified a number of technical risks which are provided below. These technical risks reflect the results of IV&V’s review of the state of the FDsys Program (see Attachment A for details).

- The PMO's current development practice focuses more on fixing and upgrading a deployed system rather than building the final system. Production builds are comprised of fixes for emergent problems, new Collections (if possible), and new "features" that have not been mapped to the system requirements. There is no overarching schedule or plan that addresses the content, development, and deployment of all the future FDsys Releases. As a result, it is difficult to determine the final version of FDsys in terms of the capabilities and functionality that will be provided to the end users. The lack of a clear system definition and detailed implementation plan prevents the PMO from determining realistic cost estimates for future development, and presents a serious risk to the PMO's ability to develop and deploy the final system.
- The PMO has not provided sufficient system engineering expertise needed to direct and oversee the development of a complex information technology system such as FDsys. The strategy of using outside contractors as Subject Matter Experts (SMEs) is acceptable in terms of the implementation and configuration of the Commercial-off-the-Shelf (COTS) products used by FDsys; however, these SMEs do not understand the GPO business processes (i.e., both "as-is" and "to-be") and the FDsys system requirements. In addition, these SMEs do not possess the technical knowledge and experience required to integrate multiple COTS products and custom software into an overall system that meets the unique needs of the PMO and the FDsys user community. The insufficient technical direction has contributed to the deployment of a beta system (i.e., Release 1) with incomplete functionality, design issues (e.g., Repository Re-factored Design), and numerous deficiencies (e.g., many PTRs). Without the addition of a senior system engineer, these problems will continue, and future Releases will likely take longer and cost more than anticipated.¹
- In December 2007, the PMO envisioned that Release 1 (previously called Release 1C.2) would establish the foundation for FDsys (e.g., setup repository, replace GPO Access, and implement the infrastructure). The subsequent Releases would build upon this foundation by adding functionality and enhancements. Since the initial deployment of Release 1, however, the PMO has dedicated the majority of its efforts to completing this Release and correcting its deficiencies. Within the first few months, a significant design change (i.e., Repository Re-factored Design) was needed to

¹ The PMO hired Flatirons Solutions in May of 2008 as a Systems Engineering and Technical Assistance Contractor (SETA). Their first task was to review the current technical and programmatic state of the FDsys program and provide evaluation and recommendations for achieving a December 2008 operational system. The final report submitted by Flatirons **"...concludes that the current approach to deliver a system in CY2008 is not achievable using the current system artifacts and development methodology."** Subsequent to their report, Flatirons was no longer involved in the FDsys Program. The PMO has not hired another SETA contractor to support the development of FDsys.

enable the processing of Collections with numerous granules. Nine (9) months after deploying Release 1, key elements associated with this Release – COOP, migration of all Collections, ILS integration – remain incomplete, and the PMO has made virtually no progress on the next major Release (i.e., Release 2). As of 30 December 2009, over four-hundred (400) open PTRs exist for the deployed system; two-hundred-thirty-two (232) of these PTRs are classified as Severity 2.² Testers and users continue to identify new problems following each Production build; thus, the overall reduction in the number of open PTRs is small.³ Based on these realities and the demonstrated progress to date, there is a serious risk that the overall goals for FDsys (i.e., all the defined features and capabilities) will take much longer and require significantly more funding to achieve.

- The near term planning for FDsys includes the implementation of the COOP facility and the transition to FDsys as “system of record” for all of GPO’s Collections. The completion of these items, however, requires a significant amount of work. According to the December Program Review (*see Reference a.*), the PMO projects COOP site stand-up no earlier than July 2010. This date may be optimistic considering that the detailed design for COOP is still not finalized and approved; the COOP hardware has just been ordered (assuming all hardware ordered by 12/16); and, the installation and testing of the COOP hardware and software may be more difficult than expected considering that the PMO has no prior experience with such an effort. Currently, FDsys contains twenty-five (25) of the GPO Access Collections. Although the PMO feels that these are the most complex Collections, it has taken nearly one year to migrate these twenty-five (25) Collections to FDsys. The PMO’s plan to complete migration of all the remaining Collections by the end of March 2010 may not be achievable or reasonable based on the experience to date. Thus, it is possible that the complete transition to FDsys as the “system of record” may occur well after March 2010.
- The deployed beta system is compromised by the existing PTRs. These problems, especially those defined by the Severity 2 PTRs, adversely impact FDsys performance and usability. They also introduce a risk to the future

² As defined in the FDsys SIT Test Plan: A **Severity 2: Adverse** PTR adversely affects the accomplishment of an operational or mission-essential capability specified by the requirements so as to degrade performance; no alternative work-around solution is known. From a user perspective, a severity code of 2 indicates an operational situation that is marginally tolerable for a short period in a fielded system but for which a solution is essential.

³ Since November 30 (i.e., during testing of the Production builds deployed in December), one-hundred-forty-four (144) new software PTRs, including six (6) Severity 1 and ninety-six (96) Severity 2, were created by the testers. The resolutions to only seventeen (17) of these new PTRs (i.e., the six (6) Severity 1 and eleven (11) Severity 2) were included in the December deployments. As a result, even though these deployments resolved a total of forty-eight (48) PTRs (i.e., the 17 new PTRs plus thirty-one (31) from previous deployments), the number of open software PTRs increased for the system.

development of FDsys because fixes to these PTRs are often included within the Production builds that implement new FDsys functionality. This complicates the deployment of these builds (e.g., requires more analysis, development, and testing).

- The Test Program continues to be hampered by the lack of clear requirements. That is, system changes (e.g., the Metadata Editor Input Tool⁴ initially implemented as part of the Repository Re-factored Design) are developed based on general descriptions of functionality; they are not a by-product of detailed design stemming from well defined system requirements. This makes it difficult for the testers to plan and prepare test cases that completely test the implemented functionality. The Test Program also lacks sufficient resources to thoroughly test the system, and is compromised by inadequate test documentation produced during the Release 1 SIT effort. Insufficient system testing is always a risk. The deployed system may not satisfy all its expected capabilities (i.e., due to the inadequate SIT effort); and, problems (latent or new) may be missed during the formal testing of a build (i.e., due to deficiencies stemming from unclear/undefined requirements and/or a limited number of test cases because insufficient testing resources). As a result, PTRs are identified following deployment. These new PTRs simply increase the development efforts for future deployments.

2. Schedule Risks Identified

There is the potential for schedule risks associated with the above technical risks. The FDsys program has already incurred significant delays in deployment and sustainment of FDsys. The currently deployed beta version of FDsys bears only partial resemblance of the system that was envisioned in the *GPO's FDsys: System Releases and Capabilities document (Reference c.)*. The lack of rigor in testing of FDsys has resulted in a system with both design/development issues and numerous PTRs that continue to be generated resulting in additional schedule delays.

In addition, Release 2 tasks and activities, initially planned for completion in FY2009; have yet to be determined as the Program continues the development of an integrated master schedule that addresses the completion activities related to Release 1 (i.e., items not included with its initial deployment) and the development of Release 2. Because of this, and as reported previously in IV&V's 8th and 9th

⁴ To date, the PMO has not finalized the requirements, System Design Document (SDD), and user documentation associated with the Metadata Editor Input Tool. Currently, only the PMO uses this Tool. The PMO plans to include the metadata editor functionality in the December 2009 Production build. However, due to issues found with the current metadata editing implementation, the PMO will have to replace the Metadata Editing Tool with Documentum xDB, a powerful search and manipulation XML store, and use of Orbeon, a COTS product that is required for XForms implementation. Note that per the PMO, initially, both the current and proposed implementations will be used.

Quarterly Reports (*see Reference d. and Reference e.*), the basis for determining overall schedule risk is not available. Without a master schedule, it is difficult for the PMO to coordinate work efforts of the various contractors and establish milestones. The capability to measure progress is compromised.

As also previously reported in those IV&V Quarterly Reports and re-affirmed in IV&V's most recent review of the state of the FDsys Program (see Attachment A), the PMO continues to find problems with the deployed FDsys that have required significant rework, e.g., the redesign of the internal Documentum system, and over four hundred (400) PTRs that have been generated since the beta deployment in March 2009. These problems have required the PMO to divert resources away from Release 2 tasks and activities resulting in schedule delays.

3. Cost Risks Identified

There are cost risks inherent with the technical issues discussed in Section 1. Though numerous deployments (i.e., updates, fixes, and enhancements to the deployed beta system) have occurred, the associated delays in completing Release 1 activities due to problems and issues that have been found continue to push Release 2 activities farther behind resulting in additional cost.

As reported in IV&V's 8th Quarterly Report, the lack of an approved master schedule for the current FDsys activities is the most significant cost risk. Without a master schedule, there are no established milestones and specified deliverables. Work continues and tasks are completed without a concrete measure of the cost to complete a specified amount of work within an allotted timeframe.

4. Recommendations

The current IV&V recommendations are provided below.

1. The PMO should clearly define the near term and long term goals for FDsys. This includes the performance of a thorough review and evaluation of the baseline system requirements/capabilities to determine what the final system needs to do for both internal and external users. The PMO should then develop a realistic plan to achieve the final system, including realistic milestones and the expected total cost to complete the system.

Management's Response. The PMO is reviewing all system requirements in conjunction with Release 1 closeout and future release planning. This requirements review will include stakeholders in order to update the priorities for enabling specific functionality in the system. The PMO will then update the FDsys Concept of Operations in order to capture this information and will develop a realistic system plan to complete this aspect of the program. This plan will address all remaining identified Release 1 requirements, however, we

believe development of FDsys will continue as new features and functionalities are identified by stakeholders, and therefore disagree with the reference to a “final system” plan. Instead, we will identify requirements for future releases and develop plans to deliver these releases on a release by release basis.

Evaluation of Management’s Response. Management’s proposed actions define the present development approach for FDsys. That is, beyond the current Release (i.e., Release 1), the existing Concept of Operations Document (CONOPS V2.0, dated May 16, 2005) and the associated Requirements Document (RD 3.2.1, dated December 4, 2007) for FDsys no longer establish the baseline for the “final system” functionalities and capabilities that the PMO plans to build and deploy. It is assumed that these documents will provide information and guidance for future Releases; however, as stated in Management’s response, the PMO believes that the “development of FDsys will continue as new features and functionalities are identified by stakeholders,” and “will identify requirements for future releases and develop plans to deliver these releases on a release by release basis.” These statements imply that the FDsys Program has transitioned to an open-ended development effort with objectives (e.g., new functionality) that will be defined by stakeholder inputs and PMO identified requirements. We assume that the PMO will prioritize these objectives and will implement them subject to the available funding for each Fiscal Year.

Our recommendation is not applicable given this development approach. The PMO does not intend to define a final system and a completion date. Thus, they do not plan to develop an overall schedule or estimated cost associated with a final system. Therefore, we are closing this recommendation upon issuance of the final report.

2. The PMO should hire a senior system engineer (i.e., Government or Contractor) to oversee the design and development of the FDsys Releases in accordance with the approved schedule established for these Releases, as well as the functionality and capabilities targeted for these Releases. This individual will direct, coordinate, and supervise the efforts of the FDsys development team (both Government and Contractors) and, he/she will have the responsibility to ensure that the system is built to satisfy the system requirements (i.e., the design and development will be driven by the system requirements).

Management’s Response. The technical leadership on this program has delivered excellent results and we fully expect this to continue.

Evaluation of Management’s Response. We believe that the details provided in this IV&V Report (and the report’s Attachment) support this Recommendation and warrant its implementation (e.g., the existence of numerous PTRs, need for major re-design after beta deployment, Release 1 functionality not fully implemented, and development not drive by requirements/detailed design).

Over a year since its initial deployment, FDsys remains a beta version. In addition, the Program is significantly over budget when compared to the original cost estimates.

Management's response indicates a complete disagreement with this Recommendation. Management is fully responsible for the design, development, and deployment of FDsys; therefore, we will defer to their assessment of the technical team. Although we do not agree with Management's response, we will close this recommendation upon issuance of the final report.

3. The PMO should concentrate its FY 2010 efforts on the stand-up of the COOP Facility, and the completion of the migration of all GPO Access Collections to FDsys. Once the migration is complete and COOP is operational, GPO will be able to "sun-set" and maintain FDsys as the "system of record". This will reduce the workload for internal users, eliminate the costs associated with GPO Access, and allow the public to utilize only one system to access all the Collections available from GPO.

Management's Response. The PMO concurs that the stand up of the FDsys COOP instance is a key effort to be completed in FY 2010.

Evaluation of Management's Response. Assuming their response implies a concentrated effort by the PMO to ensure the stand-up of the COOP Instance by the end of this Fiscal Year, the recommendation is resolved but undispositioned. It will remain open for reporting purposes until the COOP effort is completed.

4. The PMO should resolve most (if not all) of the significant Severity 2 PTRs as soon as possible. This will improve the performance of the current system and will help the deployment of future FDsys Releases. Once fixed, these PTRs will not encumber the design and development of new FDsys functionality (i.e., will not require the development and test resources needed to correct these problems as part of the new Release).

Management's Response. The PMO is currently reviewing PTRs in order to develop a PTR workoff plan in conjunction with the completion of Release 1. This plan will be developed in conjunction with GPO's Configuration Management organization.

Evaluation of Management's Response. The response to Recommendation 16 in IV&V's 7th Quarterly Report (August 2009) indicated that the IT Quality Group had a documented plan for resolving PTRs. The response further stated that the GPO IT Quality Director would be responsible for ensuring that IV&V is given a copy of this document. The response to Recommendation 4 (in this Quarterly Response) indicates that the PMO is currently reviewing PTRs in order to develop a PTR workoff plan, and that this plan will be developed in conjunction with GPO's CM organization. To-date, the IV&V group has not received any plan

from either the PMO or GPO IT Quality documenting the strategy and process for resolving open PTRs. We feel that sufficient time has been provided for the FDsys Program to produce this documentation. It is also unclear to IV&V why the Configuration Management organization would be included in development of such a plan. While the Configuration Control Board is responsible for maintaining the PTR database in ClearQuest and must approve the changes that are made to fix issues/problems that are documented in the PTRs, the Systems and Software Engineering personnel should be performing this task. We believe that the ability to resolve open PTRs and to subsequently regression test them is critical to the quality, stability, performance, and sustainability of the FDsys system. Therefore, the recommendation is unresolved and will remain open until a PTR Workoff Plan/Strategy document can be produced and implemented.

5. The PMO should clearly specify (in terms of system requirements and detailed design) the functionality to be implemented within each FDsys Production build. The PMO should develop this information prior to software development (i.e., the requirements should drive the development), and provide it in time to allow the STB to develop the necessary test documentation to adequately verify the functionality prior to deployment. For each Production build, the PMO should work with the STB to ensure there is sufficient time to execute the tests, fix identified problems, and re-test the system before deployment.

Management's Response. The PMO believes this process is in place, with the development of the release plan and schedule at the beginning of each new release cycle.

Evaluation of Management's Response. Management's Response does not address the fundamental problem associated with this Recommendation: inadequate requirements and design documentation hinders the test program. FDsys development continues to be driven by brief descriptions of planned features/capabilities and fixes to PTRs. The PMO does not use clear, testable requirements coupled with detailed design specifications to implement changes to FDsys. In addition, the PTRs contain little description of the problems and almost no details regarding their solutions. As a result, testers have minimal information to develop thorough test cases/procedures to verify system performance. This can lead to insufficient/ineffective testing which increases the risk of deploying a system with undiscovered errors (i.e., future PTRs) and/or with changes that do not fully satisfy the intended functionality (i.e., because the functionality was never clearly defined, understood, and verified).

Management cites the existing process which develops a release plan and schedule. The "plan" consists of a list of the PTRs and features targeted for the next release. The schedule contains tasks and associated dates for deployment of new Collections, and start/finish dates and percent complete values for the development of PTR fixes. The dates targeted for test and deployment are also

specified. This information, however, must be viewed in context. The PMO has not provided IV&V with a document that describes the “existing process”. Requirements (new/existing/changed) to be implemented by the release are not identified in the plan; and, details regarding the PTRs fixes are not documented. Test Reports describing how each change implemented in the release has been verified (i.e., the tests conducted and the test results) are not produced after deployment.

We believe this recommendation is crucial to the success of the FDsys Program, especially for future Releases (e.g., Release 2 and Release 3) that involve the implementation of significant new functionality (e.g., Congressional Submission, ILS Interface). While we do not agree with Management’s Response, the PMO must determine whether or not the current process satisfies the intent of this recommendation. According to the Management’s Response, they believe it does. Therefore, the OIG will close this recommendation.

6. The STB and the PMO should define a test strategy for FDsys. This strategy should be consistent with the resources available to the STB. Baseline performance of the currently deployed system must be established. The PMO and the STB should re-visit the existing Requirements Verification Traceability Matrix (RVTM) for Release 1 to determine the implementation and verification status for each system requirement assigned to this Release. Test procedures dedicated to new functionality must be developed based on the content specified by the PMO for each Release.

Management’s Response. Currently, the STB Test Lead prepares a Test Strategy for each release that lists the testing resources available to STB. Testers include testers from STB and selected PMO staff members. PMO and STB are in the process of addressing Release 1 requirements in order to update and finalize the R1 RVTM. Currently, STB prepares Test Cases as new requirements are provided from the PMO for each release. We continue to make improvements to the overall test approach for the system.

Evaluation of Management’s Response. Management recognizes the need to make improvements in the overall test approach for FDsys. However, the proposed actions do not entirely address the intent of the recommendation. A brief “test strategy” for each Release is prepared that identifies resources and the approach to verify the individual changes for that Release. But, an overall test strategy for FDsys still needs to be developed (see Recommendation 18 in *IV&V’s Seventh Quarterly Report*, dated June 11, 2009). The PMO and STB are reviewing the Release 1 RVTM; but, their current updates to this RVTM do not include the verification information for the requirements marked “implemented/verified” (i.e., the trace to the test(s) used to verify the requirement). The STB prepares test cases; but, these test cases do not cite the requirements and/or the PTR fixes they are designed to verify.

The OIG considers this recommendation unresolved; and, it will remain open for reporting purposes as IV&V continues to monitor and assess efforts to improve the overall test approach for the system.

IV&V Review of the State of the FDsys Program

November 2009

1. Description of Effort

In November 2009, Independent Verification and Validation (IV&V) performed a review of the overall state of the Government Printing Office (GPO) Federal Digital System (FDsys) Program. In particular, IV&V examined the development of FDsys with respect to the currently deployed capabilities and the expected system functionality defined nearly two years ago. This report discusses key aspects of the program based upon recent information received from the FDsys Program Management Office (PMO), as well as, the ongoing observations of the program's progress made by the IV&V team.

The following reference materials form the basis of this report:

- a. *GPO's FDsys: System Releases and Capabilities*, Version 5.0, dated December 19, 2007
- b. *FDsys Requirements Document (RD)*, Document Control Number (DCN): 7024413, Revision 3.2 (RD-3.2.1), dated December 4, 2007
- c. *FDsys Release 1 Requirements Verification Traceability Matrix (RVTM)*, dated April 16, 2009
- d. *IV&V Task Report for the FDsys Release 1 Test Program (Final - Doc Number 01-066)*, dated April 30, 2009
- e. *PMO's responses to "FDsys Program: IV&V Concerns – September 2009"*, dated September 23, 2009
- f. *FDsys FY'09 and FDsys Release 1.7.0.376 Briefing to the GPO Steering Committee*, October 2009
- g. *FDsys Test Briefing Meeting, Conference Room CTO-B714*, held on September 29, 2009.

2. Findings

2.1 System Development

Background:

In December 2007, the PMO published the baseline documentation for FDsys (*see References a. and b.*). This documentation defined all the system requirements (i.e.,

RDs)⁵ and capabilities for FDsys that would be deployed via the following three major Releases:

- Release 1C, the first public Release, consisting of:
 - Release 1C.2 (Basic Features) targeted for a November 2008 deployment
 - Release 1C.3 (Additional Features) targeted for deployment in the Spring of 2009
 - Release 1C.4 (Final Features) targeted for deployment in the Fall of 2009
- Release 2 (Enhanced Access and Capabilities)
- Release 3 (Enhanced Collaborative Tools).

The FDsys requirements baseline (v3.2.1) contained two-thousand-nine-hundred-seventeen (2917) RDs. FDsys capabilities were divided into the following ten (10) feature groups:

- Access
- Bulk Signing
- Congressional Submission
- Content Submission
- GPO Access
- Infrastructure
- Metadata Management
- Open Archival Information System (OAIS) Compliance
- Persistent Name
- Preservation and Processing

These feature groups, consisting of eighty-two (82) features, describe the functional and architectural aspects of the system. Each RD was assigned to one feature within one feature group. The total numbers of RDs targeted for each Release was as follows:

- Release 1C – One-thousand-eight-hundred-thirty (1830) RDs
 - Release 1C.2 – One-thousand-forty-six (1046)
 - Release 1C.3 – Three-hundred-twelve (312)
 - Release 1C.4 – Four-hundred-seventy-two (472)

⁵ Each system requirement in Reference b. is assigned a number in the format “RD-nnnn”, where “nnnn” is the unique numerical value for the requirement. The PMO uses “RDs” and system requirements interchangeably.

- Release 2 – Eight-hundred-eighty-three (883)
- Release 3 – Two-hundred-four (204).

Release 1C.2 Status:

The FDsys PMO has deployed and continues to update the beta version of FDsys Release 1C.2 (now called Release 1). This Release consists of two systems: the Access system, deployed in January 2009, supporting public (web-based) use; and, the Content Management system, deployed in March 2009, supporting the processing and archiving of GPO publications by internal system users. At initial deployment, FDsys contained eight (8) data Collections from the legacy GPO Access system. As of the end of October 2009, fourteen (14) additional Collections from GPO Access have been added via the deployment of several major Production builds⁶ for Release 1. These Production builds also contained a significant re-design (i.e., referred to as the Repository Re-factored Design) for the Content Management system, a new capability to support public access to FDsys information via the Data.gov website, and numerous fixes for Program Tracking Reports (PTRs) identified by testers and users.

The December 2007 baseline documentation targeted one-thousand-forty-six (1046) system requirements for Release 1C.2, encompassing part or all of the features within six (6) of the ten (10) feature groups defined for FDsys:

- Congressional Submission
- GPO Access
- Infrastructure
- Metadata Management
- OAI Compliance
- Preservation and Processing.

During development, the PMO moved some of the system requirements out of the beta version, and did not verify the implementation of others during the formal System Integration Test (SIT) effort. The final Requirements Verification Traceability Matrix (RVTM) for Release 1C.2 (*see Reference c.*), prepared by the PMO based upon the results of the SIT effort, identifies six-hundred-fifty-four (654) requirements with a “passed” status (i.e., verified by the SIT). A separate IV&V evaluation (*see Reference d.*) determined that the SIT effort did not verify four-hundred-twenty-eight (428) of these “passed” requirements. Of the remaining three-hundred-ninety-one (391) requirements listed in the RVTM, four (4) failed

⁶ A Production build is a formal update to the deployed system to implement PTR fixes and/or technical changes. A build is planned, developed, tested, approved, and placed under Configuration Management (CM) control prior to deployment.

SIT testing; three-hundred-fifty-three (353) were deemed not applicable (N/A) to the SIT effort; and, thirty-four (34) were assigned no status at all by the SIT effort.⁷ The RVTM does not specify if these requirements have been incorporated into Release 1C.2; and, if so, whether or not they have been correctly implemented and verified by some other testing. According to the PMO (*see Reference e.*), the “April 2009 RVTM is still the latest version of the RVTM.” Thus, over the last seven (7) months, no additional work has been performed to update the verification status of the remaining three-hundred-ninety-one (391) system requirements assigned to Release 1C.2. In addition, the PMO has made no changes to the RVTM to reflect the implementation of system requirements associated with the Production builds deployed since March 2009.

Table 1 provides a summary for the currently deployed FDsys beta version with respect to the number of system requirements verified during the SIT effort for each feature group implemented in this Release. Key functionality associated with those requirements targeted for Release 1C.2 but not verified/deployed is also listed in this Table.

Table 1. Implementation Summary for FDsys Release 1C.2 Feature Groups

Feature Group	No. RDs	Passed In RVTM	Key Functionality not verified by SIT Effort and/or not deployed in FDsys Release 1
Congressional Submission	57	44	<ul style="list-style-type: none"> • Internal Graphical User Interfaces (GUIs) 508 Compliant. • Capability for authorized users to search collections constrained by user role, access rights, and user group. • GPO Service Specialists provide content and metadata.
GPO Access	297	195	<ul style="list-style-type: none"> • Public User interfaces 508 Compliant. • Provide uniform display of search filters. • Capability to resolve existing PURLs and URLs. • Capability to e-mail the Federal Register Table of Contents as HTML/Text to public users. • Replacement of GPO Access as the “system of record” (only 22 of 55 Collections have been transferred to FDsys to date).
Infrastructure	446	229	<ul style="list-style-type: none"> • Capability to switch over to and switch back from a COOP Site. • Ability to perform all event and audit logging capabilities (11 of 47 RDs were verified by SIT). • Ability to manage system security (none of the 40 RDs were verified by SIT). • Capability for public users to register with the system.

⁷ There is a slight discrepancy between the baseline documentation and the final RVTM regarding the number of system requirements. The December 2007 baseline assigned 1046 RDs to Release 1C.2. The final RVTM for this Release contained 1045 of those RDs. RD-816 (“The source of converted content shall be recorded in metadata.”) was not included in the RVTM.

Feature Group	No. RDs	Passed In RVTM	Key Functionality not verified by SIT Effort and/or not deployed in FDsys Release 1
			<ul style="list-style-type: none"> • Capability to manage workflows and their associated activities (only 57 of 81 RDs were verified by SIT). • Ability to satisfy the established performance parameters (e.g., 20,000 concurrent users, response time for submitting packages).
Metadata Management	147	113	<ul style="list-style-type: none"> • Capability to link metadata and business process information. • Ability to interface with the Integrated Library System (ILS). • Capability to record the relationships among the issues or volumes of serially-issued publications.
OAIS Compliance	97	73	<ul style="list-style-type: none"> • Capability to include/process publications that are not in the scope of GPO's dissemination programs. • Capability to direct exceptions to the ingest process to authorized users other than the submitter. • Capability to create and assign a unique ID to jobs. • Abilities to process and validate Submission Information Packages (SIPs) for ingest (only 2 of 15 RDs were verified by SIT). • Ability to create an Access Content Package (ACP) from the SIP or the Archival Information Package (AIP).
Preservation and Processing	1	0	<ul style="list-style-type: none"> • Capability to translate metadata conforming to registered input standards to a registered extension schema for storage in the system.
Total	1045	654	

Since the completion of the deployment of Release 1C.2 in March 2009, the Test Team and internal users have identified numerous PTRs related to the system's operation and capabilities. From April 1, 2009 through November 10, 2009, forty-five (45) Severity 1 (i.e., Critical)⁸ PTRs were submitted against the beta version of FDsys. Thirty-two (32) of these have been closed; eight (8) were rejected; four (4) are completed but remain open; and, one (1) is still unresolved. In addition, another three-hundred-ten (310) PTRs generated over this time period remain open. This includes a total of one-hundred-sixty (160) Severity 2 (i.e., Adverse)⁹ PTRs. The PMO has included fixes to PTRs in each Production build. However, new PTRs

⁸ As defined in the FDsys SIT Test Plan: A **Severity 1: Critical** PTR prevents the accomplishment of an operational or mission-essential capability specified by the requirements. From a user perspective, a severity code of 1 indicates an operational situation that is intolerable in a fielded system and for which a solution is urgently needed.

⁹ As defined in the FDsys SIT Test Plan: A **Severity 2: Adverse** PTR adversely affects the accomplishment of an operational or mission-essential capability specified by the requirements so as to degrade performance; no alternative work-around solution is known. From a user perspective, a severity code of 2 indicates an operational situation that is marginally tolerable for a short period in a fielded system but for which a solution is essential.

continue to be identified during testing and/or after deployment of each Production build, decreasing the net reduction in the total number of outstanding PTRs.¹⁰

Release 1C.3 Status:

The three-hundred-twelve (312) system requirements originally assigned to Release 1C.3 expand Release 1C.2 by adding the capability for submission of Congressional material, enabling persistent names, and providing enhanced functionality. A summary of the expected content for Release 1C.3, based on these requirements, is provided in Table 2. The majority of the functionality of this Release is devoted to the implementation of the FDsys processing that supports the Congressional users. Based on the April 8 Kick-Off Meeting, IV&V assumes that the PMO now refers to Release 1C.3 as Release 2.¹¹ According to the PMO, planning for FDsys Release 2 is underway (*see Reference e.*); however, no specific plan has been issued. In addition, the PMO has not identified the actual content (i.e., with respect to the three-hundred-twelve (312) system requirements) that will be incorporated into this Release. In December 2007, the deployment date for Release 1C.3 was targeted for Spring 2009. Although this is long past, the PMO has yet to establish the tasks, milestones, and due dates for this Release.

Table 2. Summary of FDsys Release 1C.3 Content

Feature Group	No. RDs	Key Functionality to be Implemented in FDsys Release 1C.3
Bulk Signing	3	<ul style="list-style-type: none"> • Provide the capability to re-authenticate content that has already been authenticated (e.g., expired certificate).
Congressional Submission	179	<ul style="list-style-type: none"> • Congressional GUIs 508 Compliant. • Provide GUIs that accept submission of content by Congressional Content Originators. • Provide a Work in Progress (WIP) storage area for Congressional content prior to ingest. • Capability for authorized users to initiate jobs, monitor jobs, search for jobs, and access/edit the content related to these jobs. • Ability to acquire, maintain, and persist business process information (BPI) data for jobs submitted by Congressional users, and render the BPI on GPO forms.

¹⁰ Production Release 1.6.0.373 deployed on September 25, 2009 resolved thirty-seven (37) PTRs. During testing of this Release, twelve (12) new PTRs (including ten (10) Severity 2 PTRs) were discovered by the Test Team. From September 25 to November 10, a total of forty-four (44) PTRs have been created and are in the “submitted”, “in work”, or “reviewed” state. Of these forty-four (44) PTRs, twenty-six (26) are Severity 2; and, one (1) – discovered on 15 October – is a Severity 1.

¹¹ On April 8, 2009, the PMO conducted the Release 2 Kick-Off Meeting. This Meeting discussed the FDsys Project goals for FY 2009. These included the completion of Release 1 activities and the planning and development of Release 2. According to this Meeting, Release 2 included the processing to “enable Congressional Submission”.

Feature Group	No. RDs	Key Functionality to be Implemented in FDsys Release 1C.3
		<ul style="list-style-type: none"> • Capability to accept and manage data from the Congressional Member Database. • Capability to alert or notify Service Specialists and Internal Service Providers that a new job has been received by the system. • Maintain and process jobs prior to ingest into the system (e.g., create pre-ingest bundles). • Provide check-in/check-out capabilities for jobs. • Capability for an authorized Congressional Service Specialist to approve content so it can be submitted to GPO. • Ability for authorized users to track and update status of submitted jobs. • Allow Internal Service providers to access and modify content and metadata previously submitted by Congressional Content Originators. • Deliver content and metadata to authorized users in various standard formats (e.g., Microsoft Word).
Content Submission	4	<ul style="list-style-type: none"> • Capability for users to request re-orders. • Alert or notify the Congressional Content Originator that content submitted to FDsys consisted of files that were not successfully ingested, explanation for why content files were not ingested if available, and options for proceeding. • Determine which jobs are sent to Internal Service Providers based upon business rules.
GPO Access	27	<ul style="list-style-type: none"> • Provide public user GUIs that allow users to browse content by Government author and by collection specific metadata elements. • Provide capability for authorized users to manually assess content for section 508 accessibility compliance and transform content that is non-compliant. • Capability to maintain interactive content functionality to the extent possible. • Generate screen optimized renditions for inclusion in the DIP. • Capability for authorized users to manage descriptive text that is displayed in context specific help when a user points the mouse over an item on the user interface. • Provide GUIs that are fully functional in Mozilla Firefox 1.5.x on Macintosh, Windows, and Linux using Microsoft Internet Explorer 7.x on Windows, Netscape Navigator 7.x on Windows, Safari 2.x on Macintosh, and Konqueror 2.x on Linux.
Infrastructure	63	<ul style="list-style-type: none"> • Allow authorized users to input data to supplement system data (e.g., Web log, historical sales data). • Allow authorized users to upload files from which data will be extracted for analysis. • Allow authorized users to create custom reports and report templates based on access rights to BPI and metadata. • Ability to automatically create reports using report templates according to a schedule defined by authorized users. • Restrict Service Providers' access to Dissemination Information Packages (DIPs) and pre-ingest bundles for jobs that they have not been awarded. • Provide GUIs that allow users to input and submit registration information and login to the system, and record this information in the system. • Enable authorized users to manage user preferences. • Maintain audit logs of Content Originator ordering activities and transactions.

Feature Group	No. RDs	Key Functionality to be Implemented in FDsys Release 1C.3
OAIS Compliance	16	<ul style="list-style-type: none"> Automatically identify the digital object file format and version, and notify the user of file format validation failures. Allow users to enter notes in metadata about a file format validation failure. Notify Content Evaluators that new content has been received by the system.
Persistent Name	20	<ul style="list-style-type: none"> Assign unique persistent names to all in-scope published versions that are location independent. Capability to assign intelligent and predictable persistent names. Record the date and time of persistent name creation in metadata. Capability to create reports about persistent name management. Provide the capability for public users to use persistent names to access content.
Total	312	

Release 1C.4 Status:

The four-hundred-seventy-two (472) system requirements originally assigned to Release 1C.4 provide additional enhancements to functionality deployed with Release 1C.2 and Release 1C.3 including submission of Federal agency material. A summary of the expected content for Release 1C.4, based on these requirements, is provided in Table 3. This Release is devoted to the implementation of the majority of the requirements assigned to Access, Content Submission, and Preservation and Processing. The remaining Release 1C requirements related to Congressional Submission, GPO Access, Infrastructure, Metadata Management, OAIS Compliance, and Persistent Name are also included in Release 1C.4. In December 2007, the deployment date for Release 1C.4 was targeted for Fall 2009. Given that the PMO has not developed a detailed plan for Release 1C.3, IV&V assumes that the PMO will not perform any work on Release 1C.4 in FY 2010. Based on the extent of functionality to be implemented, an anticipated deployment date of six (6) to twelve (12) months after Release 1C.3 would be anticipated.

Table 3. Summary of FDsys Release 1C.4 Content

Feature Group	No. RDs	Key Functionality to be Implemented in FDsys Release 1C.4
Access	198	<ul style="list-style-type: none"> Provide public user GUIs that allow users to browse content by topic (i.e., subject) and by descriptive metadata elements. Capability to establish and manage links for various Collections (e.g., Congressional Bills, United States Code, Statutes at Large, Federal Register). Capability to support RSS feeds. Ability to deliver content and metadata in various formats (e.g., Word, JPEG, MPEG, CDDA, MARC XML) via HTTP/FTP downloads and using e-mail.

Feature Group	No. RDs	Key Functionality to be Implemented in FDsys Release 1C.4
		<ul style="list-style-type: none"> • Capability to access content via relationships among documents in various Collections (e.g., access Congressional Reports based on Congressional Report citations in the Statutes at Large; access granules in the Federal Register based on Federal Register page number citations in the Unified Agenda). • Ability to enable the transformation of one file format to another (e.g., transform text-based granular content into formats that have been optimized for access and delivery if these formats are not already present in the ACP). • Ingest all in-scope content on GPO's Federal Bulletin Board, Permanent Server, and Access Web Servers. • Ability to limit public access to content based on criteria specified by authorized users. • Capability to provide access to select external repositories with which GPO has formal partnership agreements (e.g., National Library of Medicine, Indiana University, Bloomington Libraries). • Allow users to manage concept relationships and to perform a search for conceptually related terms. • Enable users to manage and save search results. • Capability to support granularity down to the level of any paragraph in a publication, any individual graphic, and any embedded graphical element in a publication. • Ability to enable or disable context specific help. • Capability for authorized users to manually create new Web pages. • Capability to automatically send notifications based on business events (e.g., new version of publication available, new services available) and job processing events. • Allow all users to subscribe and unsubscribe to notification services (e.g., e-mail).
Congressional Submission	13	<ul style="list-style-type: none"> • Ability for authorized users to order jobs from term contracts from which they are authorized to purchase against. • Provide alerts or notifications to Congressional Content Originators if content related to a job is not received in WIP, explanation for why content was not received if available, and options for proceeding. • Provide a GUI that allows congressional users to submit jobs for ephemeral content. • Provide a workbench for Service Providers (e.g., GPO Service Providers and External Service Providers) that is based on their user role; and, provide a default Service Specialist workbench that provides the capability for Service Specialists to handle exception processing.
Content Submission	116	<ul style="list-style-type: none"> • Ability to determine if the version of content is already in the system using version information and bibliographic information. • Capability to allow users to specify what the intended use and access rights to the content should be, and to notify authorized users that copyrighted content has been submitted. • Allow authorized users to enter and edit BPI information and content metadata. • Provide the capability to create pre-ingest bundles (PIBs) and deliver them via FTP and e-mail. • Capability for BPI to be rendered on various GPO forms (e.g.952). • Provide a workbench for GPO Content Evaluators that is based on their user role.

Feature Group	No. RDs	Key Functionality to be Implemented in FDsys Release 1C.4
		<ul style="list-style-type: none"> • Allow Content Evaluators to make scope determinations and modify the criteria by which the system makes automatic scope determinations. • Provide the capability to verify and validate the authenticity, integrity, and official status of converted content. • Provide the capability to alert or notify the Congressional Content Originator that content submitted to FDsys consisted of files that were successfully ingested and files that were not successfully ingested. • Ability to ensure that converted content has not been altered or destroyed in an unauthorized manner during transmission from authorized users to the system, and information about content integrity should be recorded in metadata. • Capability to provide notification to the submission agency/authority that the content has been released to the intended users. • Capability to acquire, store, and edit BPI data specific fields contained on GPO forms (e.g., 2511). • Capability to determine which jobs are sent to Content Evaluators based upon business rules. • Provide job-specific, system generated "Upcoming Events" information based upon business rules and alerts and notifications.
GPO Access	1	<ul style="list-style-type: none"> • Provide searches, allow for left side stemming.
Infrastructure	26	<ul style="list-style-type: none"> • Ability to verify that the sender is, in fact, the party who claimed to have sent the converted content. • Capability to extract data according to a schedule defined by authorized users. • Maintain logs of harvested content activities, converted content activities, and version control activities. • Capability to support Public Key Infrastructure (PKI) standards. • Capability to define tasks that require more than one authorized administrator to perform (e.g., setting or changing critical system security policies, two person integrity (TPI)).
Metadata Management	84	<ul style="list-style-type: none"> • Ability to include source metadata about converted content, and record intended use in metadata. • Capability to recognize, validate, and process integrity marks. • Restrict the view of some event types and agents to authorized users. • Accept all administrative and descriptive metadata supplied by the submission agency/authority. • Record the context of a digital object and relationship to other objects in metadata, and record persistent names associated with content. • Maintain a dynamic list of series and serials from information in the ILS. • Record mandatory metadata elements associated with harvested content in the SIPs and AIPs. • Allow authorized users to modify access rights to content based on copyright information provided by Content Originators. • Capability to add new input standards to the Schema Registry. • Provide the capability to transform metadata from one extension schema to another. • Capability to ascertain and store technical metadata for a publication (e.g., software applications and versions used to create the digital objects, font sizes, font types).

Feature Group	No. RDs	Key Functionality to be Implemented in FDsys Release 1C.4
		<ul style="list-style-type: none"> • Ability to identify files with security restrictions upon submission. • Allow authorized users to input, view, and manage version information. • Capability to record superseded document information, structure of a series, and structure of a serial.
OAIS Compliance	21	<ul style="list-style-type: none"> • Capability to limit access to Sensitive But Unclassified (SBU) content as specified by authorized users. • Allow a user to manually change the format characterization in the technical metadata. • Capability for authorized users to process SIPs to conform to SIP validation. • Provide the capability for authorized users to add renditions of a publication to an AIP. • Allow users to view technical metadata included with a digital still image as specified by NISO Z39.87.
Persistent Name	5	<ul style="list-style-type: none"> • Ability to identify and resolve to multiple identical copies of a resource at multiple locations through a single persistent name. • Allow GPO to designate other systems or agencies to become recognized GPO naming authorities.
Preservation and Processing	8	<ul style="list-style-type: none"> • Provide the capability for authorized users to access AIPs for the purpose of executing preservation processes on AIPs. • Capability to perform integrity checking. • Ability to identify incomplete or unsuccessful refreshments processes and notify users.
Total	472	

Release 2 Status:

In December 2007, the PMO assigned eight-hundred-eighty-three (883) system requirements to Release 2. These requirements enhance the existing capabilities of and add new functionality to the Release 1C system. Table 4 provides a summary of the feature groups, features, and number of system requirements for Release 2. The expected deployment date for this Release is to be determined (TBD). To date, the PMO has not developed a schedule depicting the expected tasks, milestones, and due dates for Release 2.

Table 4. Summary of FDsys Release 2 Content

Feature Group	No. RDs	FDsys Release 2 Features (Associated No. of RDs) ¹²
Access	401	<ul style="list-style-type: none"> • 508 Compliant GUIs (14) • Checking/Reformatting Content for 508 Compliance (6) • Contact Management (32) • Deliver by RSS (1) • Deliver Content and/or Metadata (135) • Deliver by FTP (2) • Follow Relationships to Other Documents (3) • Format Transformation (51) • Knowledge Base (31) • Partnerships (2) • Reference Tools (10) • Save Search Query (2) • Save Search Results (2) • Search (2) • Search Results (5) • Support Granularity (2) • Training and Events (19) • User Help (14) • User Help Desk (50) • User Interface (12) • User Notification (6)
Bulk Signing	84	<ul style="list-style-type: none"> • PDF Signing Using Bulk Signing System (84)
Content Submission	117	<ul style="list-style-type: none"> • Content Submission (1) • Deliver Content and/or Metadata (1) • Pre-Ingest Processing (1) • Scope Determination (1) • Submit Content and Metadata (1) • Assignment TBD (112)
GPO Access	21	<ul style="list-style-type: none"> • Format Transformation (1) • Reference Tools (2) • Save Search Query (3) • Search (1) • Search Results (2) • User Help (1) • User Help Desk (2) • User Interface (9)

¹² As of December 2007, the PMO did not assign a Feature to two-hundred-forty (240) of the system requirements targeted for Release 2.

Feature Group	No. RDs	FDsys Release 2 Features (Associated No. of RDs) ¹²
Infrastructure	114	<ul style="list-style-type: none"> • Data Mining (55) • Enterprise Service Bus (7) • Event and Audit Logging (1) • Manage Security (1) • Storage Management (22) • System Flexibility (7) • System Monitoring (1) • User Registration (1) • User Roles (1) • Workflow Management (18)
Metadata Management	13	<ul style="list-style-type: none"> • Content Metadata (1) • Descriptive metadata (2) • ILS Integration (4) • Schema Registry (5) • Technical Metadata (1)
OAIS Compliance	3	<ul style="list-style-type: none"> • Digital Time Stamping (1) • Package Management (1) • Package Structure (1)
Preservation and Processing	121	<ul style="list-style-type: none"> • Package Structure (1) • Version Control (1) • Assignment TBD (119)
Total	874¹³	

Release 3 Status:

In December 2007, the PMO assigned two-hundred-four (204) system requirements to Release 3. These requirements enhance the existing capabilities of and add new functionality to the Release 2 system. Their implementation completes the development of FDsys as originally envisioned by the PMO. Table 5 provides a summary of the feature groups, features, and number of system requirements for Release 3. The expected deployment date for this Release is TBD. To date, the PMO has not developed a schedule depicting the expected tasks, milestones, and due dates for Release 3.

¹³ As of December 2007, the PMO did not assign a Feature Group to nine (9) of the RDs for Release 2.

Table 5. Summary of FDsys Release 3 Content

Feature Group	No. RDs	FDsys Release 3 Features (Associated No. of RDs) ¹⁴
Access	19	<ul style="list-style-type: none"> • Deliver Content and/or Metadata (12) • Deliver by FTP (3) • Reference Tools (2) • Support Granularity (2)
Content Submission	144	<ul style="list-style-type: none"> • Pre-Ingest Processing (1) • Scope Determination (1) • Assignment TBD (142)
Infrastructure	17	<ul style="list-style-type: none"> • COOP (1) • Data Mining (4) • Enterprise Service Bus (3) • Manage Security (2) • Storage Management (1) • System Backup/Restore (2) • System Flexibility (2) • System Monitoring (1) • Workflow Management (1)
Persistent Name	3	<ul style="list-style-type: none"> • Persistent name Assignment (1) • Persistent Name Resolution (2)
Preservation and Processing	20	<ul style="list-style-type: none"> • Assignment TBD (20)
Total	203¹⁵	

2.2 System Cost and Schedule

When the FDsys Program was initiated in August 2006, the PMO’s estimated cost to develop and deploy all of FDsys Release 1C (i.e., all the functionality included in Release 1C.2, Release 1C.3, and Release 1C.4) was \$16 million. Through August 2009, the PMO has spent approximately \$33.6 million obtain technical services from private contractors supporting the development of this system. According to recent information received from the FDsys Program Manager (*see Reference e.*), the PMO hopes “to ensure that the key resources from all current contractors remain on the

¹⁴ As of December 2007, the PMO did not assign a Feature to one-hundred-sixty-two (162) of the system requirements contained in Release 3. One (1) of these 161 RDs was also not assigned to a Feature Group.

¹⁵ As of December 2007, the PMO did not assign a Feature Group to one (1) of the system requirements contained in Release 3.

program” beyond the end of calendar year 2009 and (*see Reference f*), “*FY2010 contracts are in development. FY2009 contracts have been extended.*” However, the PMO is not sure what functionality will be implemented in FY 2010; so, the specific work to be performed by these contractors had not been determined as of September 2009. As a result, a definitive schedule (i.e., and Integrated Master Schedule) for the FDsys Program including anticipated costs, tasks, deliverables, and milestones (for all years and all Releases) is not yet available.

In lieu of developing a detailed schedule, the PMO plans near-term updates (i.e., Production builds) to FDsys Release 1 that address selected PTRs, deploy additional GPO Access Collections, and implement enhancements. The PMO’s next Production build for Release 1 is expected to be deployed in mid-December 2009. This Production build will contain three (3) Collections and fixes to about thirty-one (31) PTRs. Beyond this deployment, the PMO has targeted several objectives for completion by the end of March 2010 (*see Reference e.*)¹⁶: migration of approximately ten (10) smaller Collections from GPO Access to FDsys, stand-up of the COOP facility, the “sun-setting” of GPO Access (i.e., transition of GPO Access to FDsys), and initial Congressional Submission, and development of a long term solution for the metadata editing implementation (*see Reference f*).¹⁷ The PMO also continues planning for Release 2.¹⁸

The PMO’s objective to “sun-set” GPO Access is very important to the FDsys Program. The “sun-setting” activities will enable the transition from GPO Access to FDsys as the GPO “system of record”, and will allow GPO Access to be retired. These activities include the migration of the remaining Collections to the FDsys database; testing (e.g., performance, security) and verification of the final system; and, the receipt of the Authority to Operate (ATO). Upon completion of the “sun-setting” activities, the Government will maintain and users will access only one system – FDsys – for all the data Collections under GPO’s control.

The March 2010 PMO objectives, however, do not address several key aspects of the FDsys Program. First, it is not clear when the remaining functionality from Release

¹⁶ For COOP, this target date conflicts with the November 10, 2009 schedule generated by the COOP development team that indicates a June 8, 2010 “go live” date for the COOP facility assuming that the COOP hardware is ordered by November 12, 2009. On November 10, the PMO indicated that they expected to place the order for the COOP hardware on November 12. In a November 18, 2009 meeting with the PMO Program Director, IV&V was told that the FDsys Program forwarded the COOP hardware order to the GPO Purchasing/Acquisitions Group on November 12, 2009; however, that order had not been placed as of the time of that meeting.

¹⁷ According to an October 2009 FDsys Briefing given by the PMO to the GPO Steering Committee, issues were discovered with the current metadata editing implementation and will require a new approach. This approach will consist of using a Documentum xDB which is a powerful search and manipulation XML store, and use of Orbeon, a COTS product that is required for XForms implementation. Note that initially, both the current and proposed implementations will be used.

¹⁸ According to the April 8, 2009 FDsys Release 2 Kick-Off Meeting, IV&V assumes that the PMO’s planning for “Release 2” encompasses the functionality targeted for Release 1C.3.

1C.2 (see Table 1) will be implemented and/or verified. Second, there is no documented plan or strategy to prioritize and resolve the numerous open PTRs (many of which are Severity 2) that exist against the deployed system. Third, the near term plans do not include implementation of the Integrated Library System (ILS) interface¹⁹ and the migration of all the GPO Access Collections to FDsys.²⁰ Finally, the contents of Release 2 are not defined. According to *Reference e.*, the PMO “has defined several different options for the functionality that could be implemented in FY’10”; however, the PMO has not indicated how much of the functionality targeted for Release 1C.3 (see Table 2) will be included in these options.

2.3 System Test Program

Testing a system – especially a public facing system – prior to deployment is a critical task. The Test Program for FDsys has been and remains an issue. The contractor managed System Integration Test (SIT) effort conducted prior to the initial deployment of the beta version was incomplete and insufficient (*see Reference d.*). The product of this effort was a large set of poorly designed test cases that did not establish an adequate performance baseline for FDsys and could not be used for regression testing. As a result, responsibility for the Test Program transitioned to the GPO’s System Test Branch (STB), which has performed testing for all FDsys Production builds since the deployment of the beta system in March 2009.

The STB is working to define a formal test process for FDsys (*see Reference g.*). This includes the development of a baseline set of reusable test procedures to verify FDsys functionality. However, the STB faces significant problems. Attempting to create a comprehensive set of tests, including automated test procedures, for a deployed system is a labor intensive, time consuming effort. These tests must be reviewed, validated, and placed under configuration control. The need to develop new tests, to support the continual deployment of Production builds containing enhancements (e.g., the Repository Re-factored Design) and problem fixes complicates the overall test effort. In addition, the lack of clear system requirements for the functionality being implemented hampers testing. For example, the PMO practice that “maps” requirements to the system after software development (*see Reference e.*) results in the implementation of capabilities (e.g., Embargo Date) and functionality (e.g., Metadata Editor Input Tool) without associated detailed requirements, making it hard for testers to determine and verify expected performance. Most importantly, the Test Lead indicated that the structured test approach presented at the September test briefing (*see Reference g.*)

¹⁹ In April 2009, the PMO specified that the ILS interface was one of the Release 1 activities to be completed in FY 2009.

²⁰ With the deployment of three (3) Collections in December 2009 and ten (10) more Collections by March 2010, FDsys will contain a total of thirty-five (35) of the fifty-five (55) Collections currently existing in GPO Access. It is unclear how the PMO plans to “sun-set” GPO Access in March 2010 before all 55 of its Collections have been migrated to FDsys.

will be difficult to implement because the STB may not have sufficient resources to do so (i.e., the STB consists of five (5) testers that support twenty-five (25) projects within GPO).

Appendix A. Management's Response



U.S. GOVERNMENT
PRINTING OFFICE
KEEPING AMERICA INFORMED

MEMORANDUM

DATE: February 23, 2010

REPLY TO

ATTN OF: Chief Information Officer *MJ. Wood*

SUBJECT: Federal Digital System (FDsys) Independent Verification and Validation (IV&V) – Tenth Quarterly Report

TO: Assistant Inspector General for Audits and Inspections

Thank you for the opportunity to respond to the draft Tenth Quarterly Report regarding GPO's Federal Digital System (FDsys). Below are the responses to the recommendations put forth in the report.

Recommendations

1. The PMO should clearly define the near term and long term goals for FDsys. This includes the performance of a thorough review and evaluation of the baseline system requirements/capabilities to determine what the final system needs to do for both internal and external users. The PMO should then develop a realistic plan to achieve the final system, including realistic milestones and the expected total cost to complete the system.

Response: The PMO is reviewing all system requirements in conjunction with Release 1 closeout and future release planning. This requirement review will include stakeholders in order to update the priorities for enabling specific functionality in the system. The PMO will then update the FDsys Concept of Operations in order to capture this information and will develop a realistic system plan to complete this aspect of the program. This plan will address all remaining identified Release 1 requirements, however we believe development of FDsys will continue as new features and functionalities are identified by stakeholders, and therefore disagrees with the reference to a "final system" plan. Instead, we will identify requirements for future releases and develop plans to deliver these releases on a release by release basis.

2. The PMO should hire a senior system engineer (i.e., Government or Contractor) to oversee the design and development of the FDsys Releases in accordance with the approved schedule established for these Releases, as well as, the functionality and capabilities targeted for these Release. This individual will direct, coordinate, and supervise the efforts of the FDsys development team (both Government and Contractors); and, he/she will have the responsibility to ensure that the system is built to satisfy the system requirements (i.e., the design and development will be driven by the system requirements).

Response: [REDACTED] a contractor [REDACTED] is the FDsys Integration Manager, under the technical direction of [REDACTED] the GPO senior system architect. [REDACTED] has delivered excellent results in his leadership role on this program and we fully expect this performance to continue.

3. The PMO should concentrate its FY 2010 efforts on the stand-up of the COOP Facility, and the completion of the migration of all GPO Access Collections to FDsys. Once the migration is complete and COOP is operational, GPO will be able to "sun-set" and maintain FDsys as the "system of record". This will reduce the workload for internal users, eliminate the costs associated with GPO Access, and allow the public to utilize only one system to access all the Collections available from GPO.

Response: The PMO concurs that the stand up of the FDsys COOP instance is a key effort to be completed in FY 2010.

4. The PMO should resolve most (if not all) of the significant Severity 2 PTRs as soon as possible. This will improve the performance of the current system and will help the deployment of future FDsys Releases. Once fixed, these PTRs will not encumber the design and development of new FDsys functionality (i.e., will not require the development and test resources needed to correct these problems as part of the new Release).

Response: The PMO is currently reviewing PTRs in order to develop a PTR workoff plan in conjunction with the completion of Release 1. This plan will be developed in conjunction with GPO's Configuration Management organization.

5. The PMO should clearly specify (in terms of system requirements and detailed design) the functionality to be implemented within each FDsys Production build. The PMO should develop this information prior to software development (i.e., the requirements should drive the development), and provide it in time to allow the STB to develop the necessary test documentation to adequately verify the functionality prior to deployment. For each Production build, the PMO should work with the STB to ensure there is sufficient time to execute the tests, fix identified problems, and re-test the system before deployment.

Response: The PMO believes this process is in place, with the development of the release plan and schedule at the beginning of each new release cycle.

6. The STB and the PMO should define a test strategy for FDsys. This strategy should be consistent with the resources available to the STB. Baseline performance of the currently deployed system must be established. The PMO and the STB should re-visit the existing Requirements Verification Traceability Matrix (RVTM) for Release 1 to determine the implementation and verification status for each system requirement assigned to this Release. Test procedures dedicated to new functionality must be developed based on the content specified by the PMO for each Release.

Response: Currently, the STB Test Lead prepares a Test Strategy for each release that lists the testing resources available to STB. Testers include testers from STB and selected PMO staff members. PMO and STB are in the process of addressing Release 1 requirements in order to update and finalize the R1 RVTM. Currently, STB prepares Test Cases as new requirements are provided from the PMO for each release. We continue to make improvements to the overall test approach for the system.

Appendix B. Status of Recommendations

Recommendation No.	Resolved	Unresolved	Open/ECD*	Closed
1		X		03/24/10
2		X		03/24/10
3	X		X	
4		X	X	
5		X	X	
6		X	X	

Appendix C. Report Distribution

Public Printer
Deputy Public Printer
Chief Acquisition Officer
Chief Information Officer
Chief Management Officer
Chief Technology Officer