

September 29, 1998

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Deputy Postmaster General

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SUBJECT: Year 2000 Initiative: Post Implementation Verification (IS-AR-98-003)

This report presents the results of our review of the USPS Year 2000 (Y2K) Initiative. This report is the third in a series dealing with the Y2K initiative. During this review we noted that the Post Implementation Verification process needed improvement. Management agreed with our findings and recommendations. The corrective actions taken or planned are responsive to the issues raised in our report.

The cooperation and courtesies provided by your staff during the audit were appreciated.

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Attachment

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USPS YEAR 2000 INITIATIVE: Post Implementation Verification

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EXECUTIVE SUMMARY

Results in brief

The year 2000 (Y2K) problem results from the way in which computer systems store and process dates. In many systems, the year 2000 will be indistinguishable from 1900, thereby causing potential system failures.

This is the third in a series of the Office of Inspector General (OIG) reports regarding the Y2K initiative. Our first report addressed the “Awareness” and “Assessment” phases of the USPS Y2K Initiative. The second provided a preliminary assessment of the “Renovation,” “Validation,” and “Implementation” phases. Additional information on prior audit coverage is provided on page 4. As part of our audit coverage of the USPS Y2K initiative, we were asked by the Y2K Project Manager to provide a review of the Post Implementation Verification (PIV) process for effectiveness and efficiency. This report addresses aspects of that process.

Remediation of systems applications for Y2K compliance primarily rests with USPS business managers and project leaders. The application project leaders are responsible for certifying that all application code has been reviewed for date implications, remediated, tested, and documented accordingly. The Portfolio Manager certifies the application as Y2K compliant and sends the certification to the Project Management Office (PMO). The PMO then initiates the PIV process.

The PIV process, instituted by the PMO, is an independent verification of the Y2K remediation¹ process to ensure that USPS systems applications are Y2K compliant and will operate correctly in the year 2000 and beyond. The PMO is responsible for the oversight of the contractors performing PIV.

The tasks that constitute PIV were developed by the USPS PMO and contractor staff and are being carried out by contractor personnel experienced in code review and conversion. The PIV has increased Y2K accountability by requiring USPS managers to submit all of their severe and critical applications for verification. However, the PIV process could not provide reasonable assurance that all severe and critical applications (166) would be independently verified before the Year 2000. This conclusion is based upon the fact that (a) Portfolio managers have certified and submitted applications for PIV without complete documentation; (b) applications were not submitted in a timely manner; and (c) all source code that had been reviewed in remediation was being reviewed again in PIV. In addition, there

¹ A process whereby USPS systems applications are corrected in order to make them Y2K compliant.

remains approximately 400 noncritical application systems that need to be remediated before their projected failure dates.

The PMO originally hired only one contractor to perform PIV. However, recognizing the enormity of the PIV task, the PMO hired two additional contractors in June 1998. We believe there are additional procedures, such as selective statistical sampling of source code, that have not been considered that could further expedite the PIV process.

Taking timely action to implement our recommendations would allow USPS PIV contractors to process severe and critical application systems more quickly and help USPS identify application systems problems before a serious date-related failure occurs. See Appendix I for a statistical sampling plan that may be used on this project.

Recommendations

The Vice President, Information Systems should direct Portfolio Managers to:

1. Certify and submit applications within 30 days of being remediated and tested.
2. Ensure applications include all required documentation before being certified.
3. Direct contractors to (a) help USPS remediation teams develop adequate Y2K test plans and remediation documentation and (b) assist in the correction of applications sent back from PIV.

The Vice President, Information Systems should also direct the PMO to:

4. Reject application systems that are submitted without complete Y2K test plans and documentation and formally notify the responsible Vice President and Chief Information Officer (CIO) that the application was rejected.
5. Develop and implement a statistical sampling plan for reviewing application code as soon as test plans and documentation become more acceptable.

**Management
Comments**

The Deputy Postmaster General concurred with all findings and recommendations included in this report and has planned or taken corrective actions to improve USPS' efforts to meet the Year 2000 challenge.

Evaluation of Management Comments

The corrective actions USPS management has planned in response to our recommendations are appropriate and, when fully implemented, should respond adequately to the recommendations.

INTRODUCTION

The Y2K problem results from the way dates are recorded and calculated in computer systems. In the past, to conserve electronic data storage, systems have typically used two digits to represent the year, such as “98” representing 1998. With this two-digit date format, however, the year 2000 is indistinguishable from 1900, 2001 from 1901, and so on. As a result of this ambiguity, application systems that use dates to perform calculations may fail after 1999.

The USPS manages over 600 application systems related to internal and external operations. The application systems provide for critical tasks and encompass a wide variety of platform designs, operating systems, and programming languages.

The USPS conducts renovation, validation, testing, and certification of its systems applications to ensure Y2K compliance. The responsibility to ensure that application systems are Y2K compliant remains with the USPS business managers, system Project Leader, and Portfolio Manager. The PIV program is directed by the Y2K PMO, which has the responsibility for overall verification of systems applications. The PMO determined it was necessary to establish a review of systems applications, after remediation, to provide independent assurance that they were Y2K compliant. To accomplish this objective, the PMO appointed a PIV Coordinator and hired contractors to conduct PIV tests under the direction of the PMO.

Management Accomplishments

The PMO has invested considerable effort in making the PIV process successful. A few of the accomplishments include: developing standard USPS PIV procedures and processes; hiring three contractors to help perform PIV; and verifying Y2K compliance of 16 converted application systems. In addition, the PIV Coordinator is constantly revising the PIV procedures to meet the dynamics of the USPS systems environment.

Objective, Scope, and Methodology

Our overall objective was to determine whether the PIV process was effective and efficient. Specifically, we wanted to determine if the PIV process was timely and provided reasonable assurance that application systems that had been remediated were Y2K compliant.

At the request of the PMO, we reviewed the PIV process used to

independently verify Y2K compliance of USPS application systems. In accessing the PIV process, we looked at applications submitted for PIV during June and July 1998.

We reviewed numerous documents, including USPS PIV procedures, system inventories, test plans, and schedules. We also analyzed internal tracking reports developed by the PMO to monitor the progress of Y2K activities.

We also discussed USPS Y2K activities related to this report with officials in various headquarters offices, including the Y2K Project Manager and leaders, PIV Coordinator, and contracted PIV personnel. Our audit work was accomplished during the period June through August 1998. This review was conducted in accordance with generally accepted government auditing standards and included such tests of internal controls as we considered necessary under the circumstances.

Prior Audit Coverage

This is the third in a series of OIG reports regarding the Y2K initiative. Our first report was "Year 2000 Initiative" (IS-AR-98-001, March 31, 1998). During this review, we examined the awareness and assessment phases of the USPS Y2K initiative and made recommendations for improvement in several areas including assigning accountability to responsible managers. USPS Management concurred fully with our findings and recommendations.

Our second report was "Year 2000: Status of the Renovation, Validation, and Implementation Phases" (IS-AR-98-002, July 21, 1998). This report involved a preliminary assessment of the renovation, validation and implementation phases of the USPS Y2K initiative. It contained recommendations for improvement in several areas including accurately reporting the compliance status of application systems. USPS Management concurred fully with our findings and recommendations.

No prior audits were conducted by the Inspection Service or the General Accounting Office regarding specific USPS Y2K initiatives.

Post Implementation Verification

Results

Background

The PIV process, instituted by the PMO, is an independent verification of the Y2K remediation² process to ensure that USPS systems applications are Y2K compliant and will operate correctly in the year 2000 and beyond. The PMO is responsible for the oversight of the contractors performing PIV. A description of how the PIV process fits into USPS Y2K Initiative follows.

Remediation of systems applications for Y2K compliance primarily rests with USPS business managers and project leaders. The application project leaders are responsible for certifying that all application code has been reviewed for date implications, remediated, tested, and documented accordingly. The Portfolio Manager certifies the application as Y2K compliant and places it into production. The certification is sent to the PMO who initiates the PIV process.

The PMO PIV Coordinator selects the applications to send to the PIV contractor based on the application's criticality and estimated failure date. Next, the PIV testing group requests the USPS project leader to submit all application documentation, source code, test plans, and Y2K compliance testing documentation.³ The PIV group reviews testing documentation and utilizes an automated tool to identify lines of source code for date-related items to be reviewed. The PIV group then performs a 100 percent manual review of all code for any date-related items the automated tool may have missed. Finally, PIV personnel visit the office where the application is run and observe Y2K tests performed by the project leader.

Table 1, Status of USPS Application Systems Undergoing PIV, provides the total number of USPS systems applications and the status of the systems in the various stages of the PIV process as of July 24, 1998. The table indicates that only about 12.5 percent of severe and critical applications had been nominated for PIV as of this date. The timeliness of applications being nominated⁴ for PIV will be reviewed in more depth and addressed in a follow-up report.

² A process whereby USPS systems applications are corrected in order to make them Y2K compliant.

³ The PIV process has been delayed by inaccurate or incomplete source code and documentation.

⁴ The PIV coordinator nominates systems applications by choosing which applications to send to the PIV contractor based on the application's criticality and estimated failure date.

Status of USPS Application Systems Undergoing PIV as of July 24, 1998

Application Classification ⁵	Application Systems	Nominated For PIV	In PIV Process	Verified By PIV As Compliant
Severe and Critical Applications	166	21	14	5
Non-Critical Applications	464	44	35	11
Total Systems	630	65	49	16

PIV Effectiveness and Efficiency

The PIV process provided reasonable assurance that applications completing PIV were Y2K compliant. For example, during the pilot PIV process, the PIV team found that 9 of 15 systems reviewed were non-compliant. Since the formal PIV started in February 1998, all applications reviewed have been verified compliant.

However, in our view, the PIV process was not as efficient as it could have been and changes need to be made quickly. For example, the PIV team was only verifying an average of four applications per month during the period January through July 1998. In addition to the full code review, applications were submitted without documentation or test plan descriptions. Furthermore, project leaders and portfolio managers have been reluctant to send their applications to PIV, stating the PIV process is too time-consuming. The challenges facing the PIV process are discussed below.

Incomplete Submissions

Portfolio managers certified and submitted applications to PIV without complete documentation. For example, USPS PIV procedures require the submission of test plans at the time the application is submitted for PIV. However, PIV team personnel stated that they had not received complete test plans with any application submitted for PIV to date. Test plans are necessary to focus on the remediated parts of an application and also help determine where to focus source code reviews. The PIV team has been informally helping project leaders and Portfolio Managers develop test plans in order to complete PIV. Helping develop test plans diverts assigned PIV resources and slows down the PIV process.

⁵ All severe and critical application systems are required to go through the PIV process whereas the non-critical systems are “subject” to PIV at the discretion of the PMO.

Applications Not Submitted Timely

Applications were not submitted for PIV as soon as they were remediated and certified. For example, prior to July 1998, all the Information Business System Support Centers (IBSSC) combined only submitted 10 of their 330 applications for PIV. The Minneapolis IBSSC did not submit any of its 120 applications. Planning for the use of PIV resources is more difficult when applications are not submitted in a timely manner or are held and submitted in large groups.

100 Percent Code Review

At the time of our audit, the PIV team was reviewing 100 percent of the source code for all applications received. According to the PMO, it was not its original intention to do complete code reviews. This practice evolved as a means of coping with the applications submitted during the pilot PIV. The applications lacked documentation and contained a great deal of unremediated code. By contrast, the PIV team indicated that when the formal PIV process started, they found that most code had been remediated. However, documentation and test plans were still missing, thus necessitating continuation of the 100 percent code review. According to the PIV team, the average team member spends about 5 hours to review 1,000 lines of code. The USPS has 166 severe and critical application systems that contain as much as 100 million lines of code⁶. Under the current PIV process, the only way the severe and critical code could be reviewed before the year 2000 would be if at least 33 individuals reviewed code every minute of every day, including weekends, until December 31, 1999.

PMO personnel stated that the PIV process was designed to serve as a quality assurance (QA) review to help ensure the proper remediation of applications. A sound method of quality assurance starts with establishment of objectives and standards. In this case the objective is for USPS application systems to be Y2K compliant. Management has defined what it means for an application to be Y2K compliant. The next step of QA involves developing and implementing procedures to provide management with reasonable assurance that objectives and standards were met (is the application Y2K compliant?). Reasonable assurance does not imply absolute assurance and should be achieved by expending the least amount of resources. A QA function, by definition, involves an agreed upon, limited review or sampling of items or, in this case, lines of code, to spot check the quality of results involved to make an application Y2K compliant. Current procedures entail expending nearly as much effort as the remediation process itself. This is an inefficient use of staff, time-consuming, costly, and provides no guarantees that all unremediated code will be identified.

⁶ The 100 million lines of code was based on the Rough Order Of Magnitude Study dated June 1998.

We commend the PIV coordinator and contractor for establishing a high assurance level for reviewing remediated code. However, the current PIV process is so time-consuming that all severe and critical applications may not be verified before the Year 2000. Therefore, we believe a more efficient PIV approach involving the use of a well-designed statistical sampling plan could be followed with little loss to the current assurance level. See Appendix I for a statistical sampling plan that may be used on this project.

Recommendations

The Vice President, Information Systems should direct Portfolio Managers to:

1. Certify and submit applications within 30 days of being remediated and tested.
2. Ensure applications include all required documentation before being certified.
3. Direct contractors to (a) help USPS remediation teams develop adequate Y2K test plans and remediation documentation and (b) assist in the correction of applications sent back from PIV.

The Vice President, Information Systems should also direct the PMO to:

4. Reject application systems that are submitted without complete Y2K test plans and documentation and formally notify the responsible Vice President and CIO that the application was rejected.
5. Develop and implement a statistical sampling plan for reviewing application code as soon as test plans and documentation become more acceptable.

PIV Code Sampling Plan Example

This statistical sampling plan described below was designed for us by an experienced statistician and is an example that management could apply to help expedite the PIV process. If implemented, this sampling plan would replace the PIV 100 percent code inspection practice. Neither of these processes, i.e., 100 percent code inspection nor the sampling technique, will guarantee that all applications reviewed are completely Y2K compliant, but the statistical approach would reduce the amount of time necessary to complete an application review.

PIV team members told us that the number of errors found while reviewing code was low. Therefore, this sampling plan uses a low error rate (.04). An error is defined as an unremediated or incorrectly remediated date-dependent item that may cause the application to fail in the year 2000 or beyond. Table 1, PIV Statistical Sampling Parameters, shows by category of system the target parameters at 95 percent or higher confidence level with a plus/minus 1 percent precision, and the estimated maximum sample size.

To apply this plan, one would follow the existing procedures to the point of identifying date-related items using the automated tool. Next, PIV team members would calculate the number of date-related lines of code identified by the tool and the number of lines not date-related, i.e., the remainder. Using the table below, the PIV team would separately sample both universes of code. They would examine only those lines of code that appeared in each sample, starting with the date-related sample first. If an error is found, the application system containing the error should be returned to its project leader for additional rework. This plan assumes that a 100 percent code inspection will be performed for those systems containing 2,500 lines or less. During code reviews of non-critical applications, the PIV team would only review the date-related sample.

Table 1: PIV Statistical Sampling Parameters

Category of System	Confidence Level	Precision	Maximum Sample Size*
Severe	99 percent	.01	2,500 lines of code
Critical	99 percent	.01	2,500 lines of code
Non-Critical	95 percent	.01	1,500 lines of code

* Maximum sample size assumes a 4 percent error rate.

Calculate the sample size using the following formula: $n = (z/b)^2 \text{ times } (pq)$

The terms of the formula are defined as follows: n = sample size

z = confidence coefficient for desired confidence level (z = 2.58 for 99 percent confidence) and (z = 1.96 for 95 percent confidence).

b = precision desired

p = error rate expected

q = 1 minus the error rate = rate of non-error

MANAGEMENT COMMENTS

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September 23, 1998

BILLY J. SAULS

SUBJECT: Draft Response to Draft Audit Report – Year 2000 Initiative: Post Implementation Verification (IS-AR-98-XXX)

The Year 2000 Initiative Project Management Office (PMO) has reviewed the draft recommendations of the Office of Inspector General for Post Implementation Verification, IS-AR-98-XXX, dated August 31, 1998. The focus of the review was to determine whether the Post Implementation Verification (PIV) process was timely and provided reasonable assurance that systems applications that had been remediated were, in fact, Year 2000 compliant. The following is a response to recommendations:

Audit Recommendation: Transmittal of Draft Audit Report Year 2000 PIV.

The Year 2000 PMO has provided each audit finding with a recommendation within the subject document cited. A proposed corrective action and resolution are provided in each instance.

Recommendation 1. The Vice President, Information Systems should direct Portfolio Managers to certify and submit applications within 30 days of being remediated and tested.

Response. Concur. The Portfolio Managers will certify along with the functional business executives and remediation manager. For previously remediated systems not certified under the current guidelines, a schedule will be developed for their certification. A letter is being issued by the Vice President, Information Systems which directs the recommended action. Estimated completion date: October 1, 1998.

Recommendation 2. The Vice President, Information Systems should direct Portfolio Managers to ensure applications include all required documentation before being certified.

Response. Concur. The Portfolio Managers will certify along with the functional business executives and remediation manager. A letter is being issued by the Vice President, Information Systems which directs the recommended action. Estimated completion date: October 1, 1998.

Recommendation 3. The Vice President, Information Systems should direct Portfolio Managers to direct contractors to: (a) help USPS remediation teams develop adequate Year 2000 test plans and remediation, and (b) assist in the correction of applications sent back from PIV.

Response. Concur. A letter is being issued by the Vice President, Information Systems which directs the recommended action. Estimated completion date: October 1, 1998.

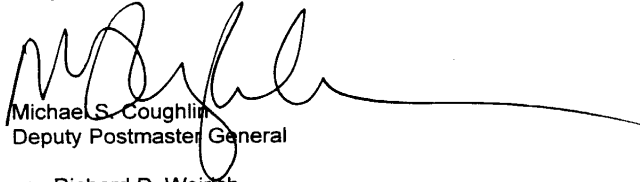
Recommendation 4. The Vice President, Information Systems should direct the PMO to reject application systems that are submitted without complete Year 2000 test plans and documentation. The PMO will formally notify the responsible Vice President and Chief Information Officer (CIO) that the application was rejected.

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Response. Concur. A letter is being issued by the Vice President, Information Systems which directs the recommended action. Further, consistent with guidance provided previously by the Office of the Inspector General, the PMO has already taken action to reject systems which are found to be improperly prepared for PIV and will now enforce the formal process in place and endorsed by the Office of Inspector General. Estimated completion date: October 1, 1998.

Recommendation 5. The Vice President, Information Systems should direct the PMO to develop and implement a statistical sampling plan for reviewing application code as soon as test plans and documentation become more acceptable.

Response. Concur. A letter is being issued by the Vice President, Information Systems which directs the recommended action. Further, consistent with guidance provided previously by the Office of the Inspector General, the PMO has already taken action to review a proposed sampling technique. A meeting of concerned parties was held (September 14, 1998) for the purpose of achieving consensus on an appropriate sampling technique. The results of that meeting will be integrated into our PIV process. Estimated completion date: October 1, 1998.



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