February 24, 2004

JOHN A. RAPP
SENIOR VICE PRESIDENT, OPERATIONS

SUBJECT: Audit Report – Network Integration and Alignment
Models – Independent Verification and Validation
(Report Number NO-AR-04-005)

This report presents the results of our self-initiated review of the Network Integration and Alignment Models project (Project Number 03YG006AC000). The overall audit objective was to determine whether the Postal Service has established adequate controls to ensure the credibility of the Network Integration and Alignment models. This review is part of an on-going audit and this report covers the process used by the Postal Service for verifying and validating the Network Integration and Alignment models.

The Postal Service conducted limited verification and validation on the Network Integration and Alignment models, but they were not independent or fully documented. The lack of independent verification and validation could increase public and congressional concerns about the objectivity of this initiative, which has significant strategic implications. We made two recommendations to address this issue. Management agreed with our recommendations and has initiatives in progress or planned addressing the issues in this report. Management's comments and our evaluation of these comments are included in the report.

The Office of Inspector General (OIG) considers recommendation 2 as significant and, therefore, requires OIG concurrence before closure. Consequently, the OIG requests written confirmation when corrective action is completed. The recommendation should not be closed in the follow-up tracking system until the OIG provides written confirmation that the recommendation can be closed.

We appreciate the cooperation and courtesies provided by your staff during the audit. If you have any questions, or need additional information please contact Robert J. Batta, director, Network Operations - Processing, at (703) 248-2100 or me at (703) 248-2300.

/s/ Mary W. Demory

Mary W. Demory
Deputy Assistant Inspector General
   for Operations and Human Capital

Attachment

cc: Paul E. Vogel
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EXECUTIVE SUMMARY

Introduction

This audit determined whether the Postal Service has established adequate controls to ensure the credibility of the Network Integration and Alignment models. This review was self-initiated and is part of an on-going audit of the Network Integration and Alignment initiative. The Network Integration and Alignment initiative will examine more than 500 facilities in the Postal Service infrastructure and affects approximately $20 billion in processing and distribution costs and $5.5 billion in transportation costs annually.

Results in Brief

The Postal Service conducted limited verification and validation on the Network Integration and Alignment models, but they were not independent or fully documented. Since network optimization was a new initiative, the Postal Service did not have policies and procedures for determining independent verification and validation requirements. The Postal Service previously used contractors to perform independent verification and validation for other systems.

Additionally, the Postal Service was reluctant to have third-party verification and validation because of concerns that an independent party could recommend another modeling approach without understanding the Postal Service and its systems. We believe that independent verification and validation of the Network Integration and Alignment models is critical because this initiative has significant strategic implications including the potential consolidation or closure of Postal Service facilities. In our view, the potential risk of making incorrect decisions based on these models outweighs the time and cost of performing an independent verification and validation.

Without third-party verification and validation of the models, the Postal Service has no independent assurance the models meet the specifications and defined objectives of the initiative and that results are valid and useful. Also, the lack of independent verification and validation could increase public and congressional concerns about the objectivity of the process.

Summary of Recommendations	We recommended the Postal Service establish policies and procedures for determining independent verification and validation requirements for the Network Integration and Alignment models. In addition, the Postal Service should use either a separate contractor or an independent Postal Service team outside the developer group to conduct verification and validation of the Network Integration and Alignment models.
Summary of Management's Comments	Management agreed with our recommendations to establish policies and procedures for determining independent verification and validation requirements and to use a separate contractor or an independent Postal Service team outside the developer group to conduct verification and validation of the Network Integration and Alignment models. Management's comments, in their entirety, are included in Appendix B of this report.
Overall Evaluation of Management's Comments	We consider management's comments responsive to the intent of our recommendations.

INTRODUCTION

Background	The President's Commission on the Postal Service found that the Postal Service has more infrastructure than it needs and many assets are no longer effectively aligned with changing requirements. The Postal Service has transitioned from a predominately manual processing and delivery environment to a highly automated environment. However, Postal Service facilities are not designed for or used in the most efficient manner. According to the President's Commission, these inefficient operations and an antiquated network cost the Postal Service billions of dollars in unnecessary expenses.

Postal Service management recognized the problem with its antiquated network and the need to consolidate or close facilities, and standardize and modernize those that remained. As part of the Postal Service Transformation Plan, the Postal Service developed a Network Integration and Alignment initiative to optimize its processing and transportation network. The charter of the initiative is to create a flexible logistics network that reduces Postal Service and customers' costs, increases operational effectiveness, and improves consistency of service. The Network Integration and Alignment initiative affects approximately $20 billion in processing and distribution costs and $5.5 billion in transportation costs annually. This initiative will examine more than 500 processing and transportation facilities.

Postal Service management formed a Network Integration and Alignment team to create a sound analytical basis for redesigning the logistics network. The team included Postal Service operational experts, a business consulting firm, and network optimization experts from industry and academia. The team developed models that were used to identify solutions and simulations to test the feasibility of the solutions. International Business Machines Consulting Services and LogicTools, Inc., jointly designed and developed the models, under contract to the Postal Service.

Objective, Scope, and Methodology	The overall audit objective was to determine whether the Postal Service established adequate controls to ensure the credibility of the Network Integration and Alignment models.

This report covers our review of the Postal Service process for validating and verifying the Network Integration and Alignment models. We interviewed Postal Service managers and reviewed documentation, provided by the Postal Service, related to modeling. We also researched and reviewed documents from various federal government agencies, private industry, and academia related to verification and validation of models. However, we did not independently evaluate the Network Integration and Alignment models.

This audit was conducted from July 2003 through February 2004, in accordance with generally accepted government auditing standards. We did not conduct tests of internal controls due to the limited scope of our review. We did not have complete and timely access to employees, reports, and data, which impacted our ability to complete this review. We discussed our conclusions and observations with appropriate management officials and included their comments, where appropriate.

Prior Audit Coverage

We issued a White Paper, entitled, <u>Network Integration and Alignment Project</u> (Product Number AC-OT-03-001, dated September 23, 2003), that described the project, reported its status, and identified project oversight.

In December 2002, the General Accounting Office (GAO) announced plans to review the Postal Service efforts to optimize the Postal Service infrastructure. The GAO's objectives were to develop an overview of the Postal Service's existing infrastructure for retail, mail processing, transportation, and delivery networks; determine planned Postal Service changes to the networks and the impact of those changes; and identify oversight issues associated with the Postal Service plans. The GAO review was ongoing at the time this report was issued.

The President's Commission on the Postal Service issued a report in July 2003. The commission praised the Postal Service for efforts to redesign the logistics network. The report also included a recommendation related to the Network Integration and Alignment initiative. The commission recommended the creation of a Postal Network Optimization Commission to make recommendations

relating to the consolidation and rationalization of the Postal Service mail processing and distribution infrastructure.

AT&T Government Solutions prepared a report, dated August 27, 2003, <u>Analysis of the Postal Service's Logistics Network and Development of a Network Optimization Model</u> for the President's Commission on the Postal Service. The commission wanted to know the excess capacity of the processing and distribution system, how it could be optimized, and the financial impact of the optimization. AT&T reported they did not obtain adequate data in time to perform an analysis. Since AT&T was to perform an independent study, they did not have access to validated and processed data from the Network Integration and Alignment project. AT&T also found that some data did not exist at Postal Service Headquarters and other data that was available needed to be validated. The AT&T report stated the Postal Service needed to collect the types of data described in the report to make strategic decisions about network improvement.

AUDIT RESULTS

Independent Verification and Validation

Since the nationwide network optimization was a new initiative, the Postal Service did not have policies and procedures for determining independent verification and validation requirements. The need for independent verification and validation should be based on the criticality of the project and available resources. The Postal Service previously used contractors to perform independent verification and validation for other systems.

The Postal Service conducted limited verification and validation on the Network Integration and Alignment models, but they were not independent or fully documented. The Postal Service Network Integration and Alignment team verified the results of each run of the optimization model. A consultant for International Business Machines Consulting Services, who was also a professor from Carnegie Mellon University, actively participated in the Network Integration and Alignment initiative. Although this consultant verified the model built by LogicTools, Inc. met the specifications and objectives defined for the model, these verifications were limited and did not qualify as independent because he was directly involved in the project. In addition, complete documentation was not available to support the scope of the verification and validation process.

Independent verification and validation methodologies are well established. Organizations throughout the federal government and industry use independent verification and validation as a control to ensure systems are adequately tested and validated. The GAO, Department of Health and Human Services, Department of Defense, National Aeronautics and Space Administration, and National Institute of Standards and Technology are just a few of the organizations in the federal government that use, have used, or recommend using independent verification and validation. Advocates of independent verification and validation include experts from industry and academia. (See Appendix A for details.)

There are several reasons why independent verification and validation was not performed on the Network Integration and Alignment models. First, the Postal Service does not have

policies, procedures, or guidance governing independent verification and validation of the Network Integration and Alignment models. Second, the Postal Service was reluctant to have independent verification and validation of the models because they were concerned that an independent contractor could conclude that another modeling approach would be better, rather than look at the current model and show how it could be made better. The Postal Service was also concerned about the time it would take an independent contractor to understand the Postal Service and its systems.

We believe independent verification and validation is critical because the Network Integration and Alignment initiative has significant strategic implications. These include optimizing the national distribution network by expansion, consolidation, and/or closure of processing facilities. In addition, the President's Commission on the Postal Service reported this initiative was the most important deliverable from the <u>Transformation Plan</u> because the initiative addresses processing, distribution, and bulk mail centers throughout the United States. According to the President's Commission, the efficiency of these facilities is imperative for the quality of service Americans expect to receive from the Postal Service.

In our view, the potential risk of making incorrect decisions based on these models outweighs the time and cost of performing an independent verification and validation. Without independent verification and validation of the models, the Postal Service has no independent assurance the optimization models meet the specifications and defined objectives of the initiative and limited assurance the results of the models are valid and useful. Also, the lack of independent verification and validation could increase public and congressional concerns about the objectivity of the process.

Management's Action	To improve credibility in the Network Integration and Alignment initiative, Postal Service management verbally agreed to conduct independent verification and validation of the models. They plan to develop policies and procedures for this process.

Recommendation	We recommend the senior vice president, Operations:
	1. Establish policies and procedures for determining independent verification and validation requirements for the Network Integration and Alignment models.

Management's Comments	Management agreed to establish policies and procedures for verification and validation by an independent, internal group. The Postal Service expects that initial policies and procedures will start to be formulated during March 2004 and will continue to be refined throughout the independent verification and validation process.

Recommendation	2. Use either a separate contractor or an independent Postal Service team outside the developer group to conduct verification and validation of the Network Integration and Alignment models.

Management's Comments	Management agreed to form an independent, internal group to conduct verification and validation of the Network Integration and Alignment models. The Capital and Program Evaluation group in the Postal Service's Finance Department will head the team performing the independent review. The Postal Service has begun selection of the group and anticipates developing a project plan during March 2004.

Evaluation of Management's Comments	We consider management's actions responsive to the intent of recommendations 1 and 2. Management's planned actions should correct the issues identified in the report.

APPENDIX A
USERS OF INDEPENDENT VERIFICATION AND VALIDATION

The GAO, Department of Health and Human Services, Department of Defense, National Aeronautics and Space Administration, and National Institute of Standards and Technology are examples of federal government organizations that use, have used, or recommend using independent verification and validation. Science Applications International Corporation is an example of private industry providing independent verification and validation on Postal Service systems. In addition, there are academic and private industry experts in the area of independent verification and validation that are frequently quoted and referenced.

- **GAO.** During Y2K, GAO recommended that agencies, such as Veterans Affairs and Small Business Administration, obtain independent verifications and validations of their systems to ensure the systems were compliant and able to run as of midnight, January 1, 2000.

- **Department of Health and Human Services.** According to Department of Health and Human Services, Food and Drug Administration, Center for Devices and Radiological Health, the Center for Biologics Evaluation and Research, validation activities should be conducted using the basic quality assurance precepts of "independence of review." Self-validation is extremely difficult. Independent evaluation is always better, especially for higher risk applications. Some firms contract out for a third-party independent verification and validation, but this solution may not always be feasible.

- **Department of Defense.** Department of Defense and the military services have recognized the growing significance of modeling and simulation for many aspects of their operations and have prepared directives and guidelines to provide general instruction on how, when, and under what circumstances formal verification, validation, and accreditation procedures should be employed. Verification, validation, and accreditation is performed when the potential risk of making an incorrect decision based on simulation outweighs the time and cost of performing verification, validation and accreditation to ensure that simulation can produce results that are sufficiently accurate and reliable.

- **National Aeronautics and Space Administration.** The National Aeronautics and Space Administration has its own independent verification and validation division that works with various customers within the National Aeronautics and Space Administration. According to the National Aeronautics and Space Administration, independent verification and validation is performed by an organization that is technically, managerially, and financially independent of the

development organization. The National Aeronautics and Space Administration has developed criteria to assess whether independent verification and validation should be applied to a given software development.

- **National Institute of Standards and Technology.** National Institute of Standards and Technology provides guidance dealing with independent verification and validation, including commercial off-the-shelf software products.

- **Science Applications International Corporation.** Science Applications International Corporation has provided full life-cycle independent verification and validation for various Postal Service systems, including the retail Point of Sale System and highly-complex mail sorting and routing infrastructure.

- A member of the University of Southern California, Center for Software Engineering, is an extensively cited expert on software engineering. He stated, "verification and validation activities produce their best results when performed by a verification and validation agent who operates independently of the developer or specification agent." This member served with the Department of Defense as director of the Defense Advance Research Projects Agency Information Science and Technology Office. His most recent research has been in the areas of software process modeling and software requirements engineering.

- An employee of Tec-Masters, Inc., a Department of Defense contractor, has worked with the Defense Modeling and Simulation Office of the Department of Defense to produce a new Recommended Practices Guide. This employee has also performed independent verification and validation on the National Missile Defense Program. This employee has written books and articles on independent verification and validation. This employee has also participated in seminars and conferences on the subject. This employee's philosophy is that whether or not a project needs independent verification and validation should be based on size and criticality of the program or project. The type of independent verification and validation should be considered based on available resources. Independent verification and validation should be conducted by either a separate contractor with a history of successful independent verification and validation programs who is not involved with the project or a qualified group within the organization but outside the developer's group. This group must be independent.

This employee provided basic rules for independent verification and validation (IVV).[1] These rules are:

1. "IVV must be an independent, third-party activity.

2. IVV must be an overlay, not an integral part of the development cycle. It is an added-value concept.

3. IVV must report to and owes its allegiance to the customer, not the developing contractor or organization.

4. Although it may share the development tools and data, IVV must provide its own tools and disciplines apart from those used in development.

5. Although flexible in terms of its starting point, IVV must verify each phase relative to itself and to its adjacent phases.

6. IVV must provide a means of validating all testable software performance requirements."

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[1] Independent Verification and Validation: A Life Cycle Engineering Process for Quality Software, New York: Wiley, 1992.

APPENDIX B. MANAGEMENT'S COMMENTS

JOHN A. RAPP
SENIOR VICE PRESIDENT
OPERATIONS

UNITED STATES
POSTAL SERVICE

February 12, 2004

MARY W. DEMORY

SUBJECT: Draft Audit Report – Network Integration and Alignment Models – Independent
            Verification and Validation (Report Number NO-AR-04-DRAFT)

Thank you for the opportunity to comment on the above-captioned draft report. The Postal
Service agrees with the recommendations contained in the report, however, we have some
concerns that certain statements contained in the draft report may be somewhat confusing.

First, in several places in the report, it is stated that the Network Integration and Alignment
initiative (NIA) will affect $20 billion in processing and distribution costs and $5.5 billion in
transportation costs annually. It should be noted that as the Postal Service continues to
successfully take costs out of the system as a result of such things as the breakthrough
productivity initiative and increased automation, the potential future savings from NIA or other
efforts decreases accordingly. Also, the report references statements made by the President's
Commission on "inefficient operations" and an "antiquated" Postal Service network. The record
service levels and increases in productivity of the last several years evidence the Postal Service's
success in and continued commitment to enhancing the efficiency of its operations.

Finally, the report seems to imply that the Postal Service has been less than forthcoming in
sharing certain information on its NIA project. The report states that the Office of Inspector
General (OIG) did not have "complete and timely access to employees, reports and data"
concerning the project. The Postal Service believes that the OIG is referring primarily to the lack
of output data from the NIA models and the failure to include OIG in a meeting with the Area Vice
Presidents. The Postal Service is still in the process of model validation and concept planning, as
initial outputs have been inconclusive. Also, the particular meeting with which the OIG is
apparently concerned was an internal meeting devoted to a number of operational planning
efforts; the NIA effort was only one part of that meeting.

The Postal Service remains committed to working with the OIG on the NIA independent
verification and validation efforts. In fact, the OIG recently has agreed to assign a senior auditor
to assist the Postal Service with these efforts in an advisory capacity.

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Recommendation 1:

That the Senior Vice President of Operations:

Establish policies and procedures for determining independent verification and validation requirements for the Network Integration and Alignment models.

Management Response:

The Postal Service agrees to establish policies and procedures for determining further verification and validation requirements for the Network Integration and Alignment (NIA) models. As the Postal Service has indicated throughout the course of this OIG engagement, however, it already has undertaken extensive steps to verify and validate the NIA models. The models went through a comprehensive review and redesign during the initial stages of the project, as reflected by several major revisions to the Model Requirements Report. Later steps, as acknowledged by the OIG report, include verification of each run of the NIA models by the NIA team, verification by a professor from Carnegie Mellon University that the model met all specifications and objectives, and verification and validation by Postal Service field operations personnel. Verification and validation by field personnel have been crucial. Even if multiple outside consultants or other independent groups verified and validated the NIA models, the Postal Service simply would not proceed in the absence of assessments provided by its own field operations personnel. These people are the ones who truly have the expert knowledge of and experience with the day-to-day operations necessary to accurately and reliably verify and validate the models.

Nonetheless, the Postal Service will establish policies and procedures for verification and validation by an independent, internal group, as indicated in the response to recommendation number 2, below. The Postal Service looks forward to obtaining input and assistance from the OIG in establishing these policies and procedures. The Postal Service expects that initial policies and procedures will start to be formulated during March, 2004 and will continue to be refined throughout the independent verification and validation process.

Recommendation 2:

That the Senior Vice President of Operations:

Use either a separate contractor or an independent Postal Service activity outside the developer group to conduct verification and validation of the Network Integration and Alignment models.

Management Response:

The Postal Service agrees to form an independent, internal group to conduct verification and validation of the NIA models. The Postal Service chooses to form an internal group, rather than use an outside consultant, for several reasons. First, given that most of the larger consulting firms capable of undertaking such a task bid on the NIA project to begin with, we have reservations about how independent any such group could be. After all, in order to bid on the project, the consulting firms had to review fairly detailed plans and fundamentally accept the project as outlined. Second, the Capital and Program Evaluation group in the Postal Service's Finance Department will head the team performing the independent review. This group has experience in performing independent reviews of large and complex projects such as the transportation agreement with Federal Express.

Although the internal group will be headed by a functional organization outside of the NIA developer group, some members of the group will be drawn from operations personnel not involved with the original development effort. This expertise is needed to ensure that the intended objective of the review, which is to determine whether the models perform accurately, reliably and realistically, is achieved. The Postal Service has begun selection of the group. We anticipate a project plan will be developed during March, 2004.

John A. Rapp