Office of Inspector General
Audit Report

DOT DOES NOT HAVE AN EFFECTIVE ENTERPRISE ARCHITECTURE PROGRAM FOR MANAGEMENT OF INFORMATION TECHNOLOGY CHANGES

Department of Transportation

Report Number: FI-2012-086

Date Issued: April 17, 2012

Memorandum

U.S. Department of Transportation

Office of the Secretary
of Transportation
Office of Inspector General

Subject: <u>ACTION</u>: DOT Does Not Have an Effective Enterprise Architecture for the Management of Information Technology Changes
Report Number: FI-2012-086

Date: April 17, 2012

From: Louis King
Assistant Inspector General for Financial and
    Information Technology Audits

Reply to Attn. of: JA–20

To: Chief Information Officer

With approximately $3 billion in annual expenditures, and reliance on about 400 information technology (IT) systems to conduct business and meet its missions, the Department of Transportation (DOT) has one of the largest IT investments in the Federal Government. Under the Clinger-Cohen Act,[1] each Federal department must implement a management framework that ultimately reduces its IT expenditures through investments in projects with reasonable costs and solid management of acquisition risks. This framework—commonly referred to as an "enterprise architecture" (EA)—describes both a department's current state of IT operations (the baseline architecture) as well as the future state of these operations after the implementation of improvements (the target architecture). This framework also includes a transition plan to move from the baseline to the target architecture. The purpose of EA is to save costs, reduce duplication of systems, align information technology to agency missions, and maximize benefits of security investments.

DOT has expended approximately $48 million on EA, and for fiscal year 2011 and beyond, has requested an additional $25 million.[2] In 2006, the Government Accountability Office (GAO) reported[3] that DOT's EA efforts suffer from a lack of commitment and departmental oversight. To obtain a view of the Department's current EA program, we conducted this review. Specifically, our objectives were

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[1] Clinger-Cohen Act (formerly the Information Technology Management Reform Act), Pub. L. No. 104-106 (1996); codified at 40 U.S.C. § 11101, *et seq.* (2011).
[2] Exhibit B provides a summary of DOT's EA funding by component.
[3] GAO, *Leadership Remains Key to Establishing and Leveraging Architectures for Organizational Transformation*, GAO-06-831 (Washington, DC: August 2006).

to determine whether DOT has (1) an effective program for the development and oversight of a Departmentwide EA; and (2) established procedures for the assessment of EA activities.

To accomplish our objectives, we met with the Department and the components' Chief Information Officers (CIO), and EA and capital planning and investment control (CPIC) representatives to determine the history of DOT's EA implementation and the status of each component's EA. In this report, "components" refers to the Department's ten Operating Administrations as well as the Office of the Secretary (OST), the Office of the Inspector General (OIG), and the Surface Transportation Board (STB). We reviewed and analyzed documents on components' systems, current EA architectures, and relevant policies and procedures. We also reviewed OIG and GAO reports. We conducted this audit between February 2011 and February 2012 in accordance with generally accepted Government auditing standards. A detailed description of the scope and methodology used on this audit can be found in Exhibit A.

RESULTS IN BRIEF

DOT does not have a Departmentwide EA program, as required by Clinger-Cohen. In 2000, DOT assigned authority for EA development to its components, but never planned for the integration of the components' EAs into a single, Departmentwide EA. Furthermore, the components' EA programs are incomplete. For example, the components have not completed their EA policies, procedures, and baseline architectures. The lack of comprehensive policies and procedures at both the Department and component levels and the variations in the components' EAs increase the likelihood that the components' EAs cannot be easily integrated into a Departmentwide EA. In response to an OMB request for the status of DOT's EA program, the Department recently established a repository for component EA information. However, the Department has not provided direction on what information components should provide. As a result, the incomplete repository contributes to difficulties in information sharing and identification of redundancies, and limits the reuse of resources—primary objectives of an EA program. Finally, because most components have not included security costs in their EA programs, as required by the Federal Information Security Management Act (FISMA), DOT cannot effectively manage IT security funding. DOT and component officials attributed these deficiencies to personnel losses and the dissolution of the departmental EA program office, among other things. In 2009, DOT hired a Chief Architect, but to date, no staff have been hired to execute and manage an EA program.

DOT does not have procedures for Departmentwide EA assessment, and consequently, cannot measure the status and progress of its components' EAs.

OMB's guidance states that each Department should measure its EA activities against quality standards, and that, in order for management to benefit from EA, each department should regularly report EA quality measurements to appropriate officials. However, the Department's CIO has not developed a program to monitor EA activities and does not require components to report EA performance measures, their plans for improvements to EA programs, or cost savings achieved. Still, in response to a 2011 GAO data request,[4] DOT reported that it had saved approximately $83 million in fiscal year 2009 as a result of its EA. However, DOT officials could not produce any evidence of these savings or show how they were calculated. Other than FAA's non-National Airspace System (NAS), the components do not use EA measurement programs. Of the five components that have procedures to address performance measures, only one could provide evidence of implementation. This lack of Departmentwide performance measurements and accountability inhibits DOT's ability to measure EA's benefits for its decision-makers, and reduce costs in its IT investments.

We are making a series of recommendations to assist the Department in its establishment of an effective Departmentwide enterprise architecture program.

BACKGROUND

In 1996, Congress enacted the Clinger-Cohen Act to address longstanding problems related to Federal IT management. Clinger-Cohen requires the head of each Federal agency to establish a process that maximizes the value of IT investments, and assesses and manages the risks of IT acquisitions. Under the Act, agencies must implement IT projects that contribute to tangible and observable improvements in agencies' missions at acceptable costs and within reasonable timeframes.

Clinger-Cohen also requires each agency's CIO to develop, facilitate the implementation of, and maintain an agency-wide EA program that integrates agency business processes with agency goals. These EA programs are to establish baseline and target architectures, and transition plans for program management and investment decisions. Sections 53 and 300 of OMB Circular A-11, "Preparation, Submission, and Execution of the Budget," and Circular A-130, "Management of Federal Information Resources," establish policy for the management of Federal information resources, and require Federal agencies to align their IT investments to their EAs.

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[4] In 2011, GAO initiated a survey of Federal departments and agencies' efforts to measure and report EA results and outcomes. Subsequently, and in response to a congressional mandate, GAO announced a Governmentwide engagement on EA results and outcomes.

In September 1999, the Federal CIO Council[5] published the Federal Enterprise Architecture Framework (FEAF)[6] to provide Federal agencies with a common construct for their architectures, and facilitate the coordination of system investments among Federal agencies. A FEAF model describes an agency's business, the data necessary to conduct the business, applications to manage the data, technology to support the applications, and security measures that ensure the protection of information resources. In August 2010, GAO issued *A Framework for Assessing and Improving EA Management (Version 2.0)*, an update of a 2003 version. In June 2009, OMB issued *Enterprise Architecture Framework v 3.1.*

Development and implementation of an EA require rigorous, disciplined management practices and maintenance that ensures that the EA is always accurate. Regular assessments are necessary to keep an EA aligned with its department's strategic missions and priorities, changing business practices, funding profiles, and new technologies. According to OMB and the Federal CIO Council,[7] an effective EA program consists of a number of important elements,[8] including a governance structure, departmentwide policy, and management plans. The guidance for Federal departments from these two agencies and GAO on EA management practices provides end-to-end processes for an EA program's development, implementation, and maintenance, including:

- initiation and organization;
- needed management controls;
- factors that go into decisions on EA development;
- steps for the definition of current and target architectures and a plan for transition from the current to the target;
- how to ensure that the EA is implemented and enforced; and
- how to systematically keep the EA current.

Regular assessment of a departmentwide EA program requires a repository for the storage of EA-related information from the department's components, such as summaries of IT investment portfolios, metrics for investment performance, data from IT applications, and plans for security maintenance. This repository stores the information in a readily retrievable form. It may be as simple as a shared directory with department EA artifacts, or it may include databases, web portals or

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[5] The CIO Council is the principal interagency forum on the improvement of agency practices related to use of Federal information resources.

[6] A framework and high-level process that is not prescriptive, but that provides a method for the implementation of EA in a uniform way. FEAF includes requirements for change drivers—business needs, such as new missions or assumption of large plans, and technical needs, such as unsupported platforms or obsolesce.

[7] Federal CIO Council, *A Practical Guide to Federal Enterprise Architecture,* Version 1.0 (February 2001).

[8] These elements are encapsulated in GAO's EA framework, which defines 59 elements and practices critical to an effective program (GAO, *A Framework for Assessing and Improving Enterprise Architecture Management (Version 2.0),* GAO-10-846G (Washington, DC: August 2010)).

EA-specific modeling tools. The repository also facilitates information sharing among components so they can avoid redundancies in their IT applications and systems.

DOT DOES NOT HAVE A DEPARTMENTWIDE EA PROGRAM

DOT does not have a Departmentwide EA program. Instead, DOT has assigned authority for EA development to its components, but has no plan to integrate their individual EA programs into a Departmentwide program. However, the components' EA programs are incomplete. Specifically, they have not finalized their EA policies and guidance, completed or updated baseline architectures, or defined target architectures. Furthermore, the components have not integrated their programs with their IT investment practices. In March 2011, in response to an OMB request for information on EA development status, DOT established a repository for EA information, but has not yet defined what information the components must provide. Most of the components also have not included security in their EA programs, and none could support their security funding requests.

DOT's EA Policies and Procedures Are Outdated and Incomplete

DOT does not have a Departmentwide EA program and lacks adequate policy and procedures to develop an EA. Clinger-Cohen requires an EA program and OMB requires related policies and procedures. DOT's current EA policy[9] outlines roles and responsibilities for components' compliance, but it is outdated and does not cover all of the elements specified by OMB. For example, the policy references DOT offices that no longer exist but that have not been replaced. Furthermore, the policy does not address metrics that measure the progress in an EA's development, integration, and use over time.

The Department's EA procedures, entitled Integrated Program Planning and Management Governance and Practitioners Guides (IPPM), dated March 2010, is also deficient since it does not incorporate all of OMB's requirements and lacks the necessary detail for execution. For example, the procedures do not address the alignment of EA to IT investments or address the interoperability of existing systems. Furthermore, they do not specify the people, processes, and tools necessary to implement a program.

When it began EA planning in early 2000, DOT assigned authority to the individual components for development of EA programs, but never planned for the integration of the components' EAs into a single, Departmentwide EA. We found that the components have made some progress in the groundwork for their

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[9] DOT Order 1351.27; Chief Information Officer Policy (CIOP) Chapter 1351.27, dated September 25, 2009.

individual programs, but their EAs remain mostly incomplete. For example, the components have completed only 2 of the 59 core elements of GAO's EA Framework. These core elements are the building blocks of EA management. The completion of the activities described in the elements will enable management to mature its EA program and maximize achievement of EA benefits. Exhibit C presents DOT's progress in completion of the activities described by each element in GAO's Framework, and identifies areas that remain deficient or have not been addressed. These deficient areas include incomplete policies, procedures, and baseline architectures; the absence of defined target architectures; and the integration of EA with IT investment practices.

In the absence of Departmentwide guidance, components have developed their own policies and procedures, though the majority of them have not been finalized. We found that only four components—FAA, the Federal Highway Administration (FHWA), the Federal Railroad Administration (FRA), and the Maritime Administration (MARAD)—have EA program policies, though the policies do not incorporate all OMB requirements. Furthermore, these four components' procedures are incomplete. Specifically, they do not:

- Have sufficient detail to enable continuous EA maintenance and oversight;

- Have sufficient detail to support strategic planning, EA performance improvement planning, IT management, and capital planning and investment control processes;

- Describe the generation and maintenance of EA documentation;

- Promote information sharing through the use of standardized data the Department has adopted the National Information Exchange Model, the use of which results in data formatted in a consistent manner and enables information sharing; however, FHWA, FRA, and MARAD informed us that they are individually developing data standards;

- Incorporate analysis of departmental missions into EA maintenance and IT investment planning;

- Provide sufficient criteria for the choice of IT applications, or tools, for use in EA information management; EA programs must decide what applications will be used to graphically and textually capture EA information; FAA and PHMSA use software specialized for EA modeling while the remaining components use non-specialized software such as Microsoft Word, Excel, and PowerPoint.

DOT and component officials reported that the Department's EA program has been impacted by both budget cuts and personnel losses, including the disbanding of the departmental EA Program Office. DOT's Chief Architect, hired in 2009, informed us that he initiated discussion with the components on EA but has had no staff to develop a comprehensive EA program. Furthermore, OCIO officials informed us that the Department is reviewing EA work to determine future direction, and that this review will include completing or updating the Department's EA policy and procedures. The Department's IT governance group—the Investment Review Board—is a key part of this process. However, it has not met since February 2011.

Because of the Department and components' lack of comprehensive EA policies and procedures, the existing EA programs vary and are sometimes inadequate. As a result, it will likely be difficult to integrate the components' architectures into a Departmentwide EA. These inadequate policies and procedures have contributed to the other issues we identified.

DOT Has Just Begun Collection of Components' Information for Its EA Repository

Until recently, DOT did not have a repository for EA information as required by OMB. An EA repository is a mechanism for the storage and retrieval of an EA's content. In its response to OMB's February 2010 request for information on departmental EA progress, DOT began to collect and maintain information on components' EA programs on its SharePoint Website.[10] However, this Website is a work-in-progress and is incomplete. In the past, OCIO has had incorrect information about the status of components' EA development. For example, in March 2011, prior to the establishment of the repository, OCIO reported to OMB that OST's EA for its GRANTS System, and FAA's EA for the NAS were complete, and reported the financial management systems' EA was in progress. However, it could not provide evidence to support those statements. In fact, in May 2011, OST management officials informed us that they are actually still developing EA plans for its GRANTS and financial management systems.

Even though it has set up the repository, OCIO did not provide a plan for its use and has not defined what information it should contain. Furthermore, neither DOT nor its components have sufficient information to fully populate the repository. OMB requires a properly developed repository to support agency staff in strategic planning, IT investment planning, and system life cycle development. Because DOT has delegated authority for EA development to its components, the information for the repository must come from the components' programs.

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[10] FAA uses its Knowledge Services Network Website.

However, the components have made limited progress in the development of their baseline architectures, have not defined their target architectures, and lack transition plans. These deficiencies result in insufficient information to complete an EA repository which in turn impedes the Department's ability to use components' architectures to build a Departmentwide architecture. Specifically:

- FHWA, the Federal Motor Carrier Safety Administration (FMCSA), the Federal Transit Administration (FTA), MARAD, the National Highway Traffic Safety Administration (NHTSA), OIG, OST, the Pipeline and Hazardous Materials Safety Administration (PHMSA), the Research and Innovative Technology Administration (RITA), and STB[11] do not have up-to-date baseline and target architectures and transition plans;

- FAA's NAS and non-NAS have not updated their target architectures and transition plans; their EAs are also not integrated, though FAA has plans to integrate them in fiscal year 2012;

- FRA has not properly updated its target architecture and transition plan.

The lack of a complete and effective repository contributes to poor IT investment planning, inadequate system development, data that cannot be integrated or shared, and limited reuse of resources.

The Department Has Made Little Progress in Its Reduction of IT System Duplication and Program Redundancy

In response to a 2011 GAO survey regarding Federal EA programs, the Department reported that it has made little progress in its reduction of duplicate applications, use and reuse of common services and data, improvement in system interoperability, and streamlining and consolidation of similar business processes. OMB requires the use of EA to identify duplication and opportunities for consolidation and reuse of technology within and across agencies. For example, nine components[12] each maintain and fund their own PRISM[13] systems. OST management officials informed us that the Department plans to integrate these systems through business process reengineering and consolidation, but provided no plans for these efforts.

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[11] The St. Lawrence Seaway Development Corporation (SLSDC) received an exemption from EA activities from OCIO in March 2011.

[12] FAA, FHWA, FMCSA, FRA, FTA, OST, NHTSA, PHMSA, and RITA.

[13] An application that automates DOT's procurement processes, from requisition through contract award.

As GAO noted in a March 2011 testimony before Congress,[14] DOT has five components with 6,000 employees that administer over 100 programs with separate funding streams for highways, transit, rail, and safety functions. Moreover, DOT has approximately 100 surface transportation programs alone within FTA, FMCSA, FHWA, and NHTSA that it has not reviewed for duplication and redundancy. An OCIO official noted that the Department's federated approach to EA development encourages stove-piping of policies and procedures at the expense of information-sharing and resource reuse. Because it does not have an integrated EA program, DOT's ability to identify and reduce duplication of systems or redundant data is limited. Consequently, the Department may be operating costly duplicate systems and redundant programs.

DOT and Its Components Do Not Address Information Security in Their IT Investment Management and EAs

Neither the Department nor the components sufficiently address IT security in their IT investment planning and management, and 12 of the 13 components have not included security as part of their EA program development. FISMA and other statutes and regulations require departments to integrate IT security into their capital planning and EA processes. Furthermore, GAO and OMB recognize security as one of the core elements that measure the effectiveness of EA and IT investment programs. However, the Department does not provide guidance to the components on the inclusion of IT security in their budget submissions. For the estimated $44 million they requested for fiscal year 2012, the components, with the exception of NHTSA, did not provide adequate information on their security investment processes or security architecture to support their projections. See Table 1 for details.

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[14] *Opportunities to Reduce Potential Duplication in Government Programs, Save Tax Dollars, and Enhance Revenues,* GAO-11-318SP (Washington, DC: March 2011).

Table 1. Components' FY 2012 Security Funding, Investments Processes, and Architecture

	Total IT investment dollars in millions[a]	Security dollars in millions[a]	Security Investment Process[b] (Yes, No, Partial)	Security part of EA[c] (Yes, No)
FAA	203	32,427	Partial	No
FHWA	47	2,086	Partial	No
FMCSA	4	1,528	Partial	No
FRA	21	297	Partial	No
FTA	11	101	No	No
MARAD	4	0	No	No
NHTSA	21	58	Yes	Yes
OIG	2	260	No	No
OST	19	6,846	No	No
PHMSA	11	312	No	No
RITA	13	619	No	No
SLSDC	1	0	Yes	N/A[d]
STB	4	0	No	No
Total:	361	44,537		

[a] Source: WorkLenz–the Department's investment portfolio system–as of March 13, 2011.
[b] An organization's approach to its selection, management, and evaluation of IT security investments.
[c] An organization addresses security in its EA in order to consistently address security across its business, performance, information and data, applications and services, and technology architecture products.
[d] OCIO granted SLSDC a waiver from EA activities in March 2011.

According to OCIO officials, the Department does not have a methodology for estimating, tracking, and reporting return on security investments, or the use of risk analysis and return on investment to determine which security controls to fund. Consequently, the components use their own calculations and self-report their security funding needs to OCIO. However, we found that the components could not support their calculations and OCIO did not hold the components accountable for the information they reported to OMB.

OCIO reported that in fiscal year 2012, it will focus on policy updates, implementation of practices for security cost estimations, management, reporting, and EA alignment, but provided no plans for these efforts. The lack of these policies and practices, including a Departmentwide methodology for security funding estimations, makes it difficult for the Department to manage IT security in support of its missions and business needs.

THE DEPARTMENT HAS NOT DEVELOPED PROCEDURES FOR EA ACTIVITY ASSESSMENT

DOT does not have procedures for EA assessment, and consequently, cannot measure the status and progress of its components' EAs. OMB and GAO have noted that as with any investment, EA should produce benefits, or returns on investment that can be measured against costs. OMB's guidance states that each department should measure its EA activities against quality standards—metrics defined in an EA development and maintenance methodology that assess an EA program's ability to assist management's decisions on IT changes and investments. OMB further states that, in order for management to benefit from an EA, each department should regularly report EA quality measurements to appropriate officials. However, DOT does not have a Departmentwide program[15] for EA activity monitoring, and does not require components to report EA performance measures, their plans for improvement of EA programs, or EA's cost savings. Nevertheless, in its response to GAO's 2011 survey regarding EA activities, DOT reported that it had saved an estimated $83 million in fiscal year 2009 as a result of its EA. However, DOT could not produce any support for these savings.

For the most part, the components do not have performance measurements for their EA activities. We identified the following issues in their programs:

- With the exception of FAA's non-NAS, the components did not provide evidence of EA measurement procedures or practices for reports on their EA programs' status to the Department, or plans to establish procedures;

- NAS's Chief Architect and FAA management are still developing a measurement program;

- While FHWA, FMCSA, FTA, PHMSA, and SLSDC have finalized policies and procedures that address information security performance measurements, only SLSDC provided evidence of policy and procedure implementation;

- Components' officials did not provide evidence that they analyze departmental missions and revise mission-related processes based on those analyses before they make significant IT investments in support of the missions.

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[15] The Department has initiated collection of information on IT investments for use in assessments of the investments' performance, but does not include information on EA performance.

The lack of a Departmentwide performance measurement program and accountability inhibits DOT's ability to achieve costs savings and measure the direct benefits of EA value to Agency decision-makers. Consequently, management cannot track architecture development and use, or monitor the impact and resulting savings of EA products and services on IT and business investment decisions, collaboration, and reuse.

CONCLUSION

DOT annually invests approximately $3 billion in IT in order to conduct business and meet its missions. However, the lack of a Departmentwide EA program severely limits DOT's ability to ensure that its IT investments are properly planned, selected, prioritized, justified, and cost-beneficial. Furthermore, because the Department lacks assessment procedures, it cannot measure its progress towards effective implementation of its IT investments to meet its missions. Without a Departmentwide EA program, DOT cannot be sure that it is maximizing returns on IT investments through cost savings, reduction in duplicative systems, alignment of information technology to mission, and effective information security spending—critical requirements in an environment of scarce resources.

RECOMMENDATIONS

To ensure successful completion and implementation of an enterprise architecture program, we recommend that the Department's Chief Information Officer, in coordination with the components:

1. Develop and/or revise the Department's EA policy and procedures to address the following:
   a. Development, maintenance, and use of EA in the IT investment process;
   b. Incorporation of the Department's Governance groups into the CPIC and Enterprise Architecture processes to provide oversight and improved decision making relating to IT investments, including security funding;
   c. Creation of a standardized methodology that provides reliable estimates of security funding needed for system investments;
   d. Development and implementation of performance measures to gauge the Department's application of EA, including investments in system security;
   e. Tracking and formal documentation of EA changes;

2. Assist components in the selection and implementation of compatible EA tools that will facilitate the creation of a Departmentwide EA;

3. Input the required data (such as business processes, workflows, and technology in use) in the selected EA tools to develop or update current and future architectures and transition plans;

4. Develop and implement a Departmentwide data management practice that provides a common data dictionary that reflects commonalities in data and processes and provides methods for sharing information across the Department;

5. Develop a process to measure components' EA programs' maturity and effectiveness using key framework elements outlined in OMB's Enterprise Architecture, and develop a plan to remediate any gaps or deficiencies found;

6. Develop a plan and work with the components to identify redundancy in current operations and technology use across the Department;

7. Identify and report EA performance measure results, outcomes and progress to DOT's Governance groups and decision makers to ensure that they have the proper information to make EA and related information security decisions;

8. Create a Departmentwide EA that is consistent with OMB and GAO's frameworks and meets the requirements of the Clinger-Cohen Act.

AGENCY COMMENTS AND OIG RESPONSE

We provided the Department's OCIO with a draft of this report on February 8, 2012, and received its written response on March 21, 2012, which is included in its entirety as an appendix to this report. In its response, OCIO concurred with recommendations 1, 2, 3, 6, and 8. Due to funding constraints, OCIO partially concurred with recommendations 4, 5, and 7. Once funding is obtained, OCIO plans to take actions to address these recommendations.

ACTIONS REQUIRED

We consider OCIO's planned actions and target dates responsive to all our recommendations and consider them resolved but open pending completion of the planned actions. We appreciate the courtesies and cooperation of the Department of Transportation's representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-4350.

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cc: Martin Gertel, M-1

EXHIBIT A. SCOPE AND METHODOLOGY

We reviewed applicable Department policies, procedures and management practices; laws, regulations, and guidelines that address EA and CPIC; and, Departmentwide and component documentation. Because of its formal waiver for EA from OCIO, SLSDC was exempted from our assessment of EA but were included in the IT investment review. We reviewed and assessed DOT's EA tools, including DOT's SharePoint Website and FAA's KSN website, to review relevant content within components' EAs and determined if the Department had implemented and maintains an automated EA modeling tools. We also reviewed EA investments and documentation (IT modernization plans/blueprints) by reviewing components' investments and determined alignment to DOT EA. In addition, we reviewed all component IT investment governance practices and assess their Capital Planning Investment Control (CPIC) program to determine if information security is effectively addressed in the IT Investment Management. We interviewed key personnel, including contractors, at OST, OCIO, and DOT's component. We conducted site visits at DOT Headquarters in Washington, D.C. Additionally, we reviewed prior GAO and DOT reports and evaluated progress reported on the implementation of recommendations.

In our evaluation of the Department's current and target EA development, and quality of the EA program, we used OMB and GAO guidance, and NIST SP series. For instance, OIG used as a benchmark GAO's *A Framework for Assessing and Improving Enterprise Architecture Management* to determine if the Department satisfied all 59 core elements for the development, maintenance, and use of an EA. OIG also used OMB's EA Framework, which consists of three capability areas: 1) completion; 2) use; and 3) results. OMB's capability area representations of the critical success attributes are fundamentally aligned and substantially consistent to GAO's core elements. See Exhibit C for the 59 core elements, the three capability areas, and our aggregate assessment of DOT components' EA programs.

This performance audit was conducted at DOT and FAA Headquarters in Washington, D.C., in accordance with generally accepted Government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

EXHIBIT B. DOT COMPONENT ENTERPRISE ARCHITECTURE FUNDING SUMMARY

DOT Components[a]	Enterprise Architecture Funding	
	FY 2010 & Earlier (millions)	FY 2011 and beyond (millions)
Federal Aviation Administration (FAA)	$19	$14
Federal Highway Administration (FHWA)	1	.4
Federal Motor Carrier Safety Administration (FMCSA)	3	.5
Federal Railroad Administration (FRA)	2	4.3
Federal Transit Administration (FTA)	1.6	.7
Maritime Administration (MARAD)	5	.1
National Highway Traffic Safety Administration (NHTSA)	4.8	3.1
Office of Inspector General (OIG)	0	0
Office of the Secretary (OST)	12	1.9
Pipeline and Hazardous Materials Safety Administration (PHMSA)	Not Reported	Not Reported
Research and Innovative Technology Administration (RITA)	0	0
Saint Lawrence Seaway Development Corporation (SLSDC)	0	0
Surface Transportation Board (STB)	.1	.06
Total	$48	$25

Source: WorkLenz as of March 13, 2011
[a] For purposes of reporting under EA, we consider "DOT Components" to include all organizations listed above.

Exhibit B. DOT Component Enterprise Architecture Funding Summary

EXHIBIT C. ASSESSMENT OF DOT'S ENTERPRISE ARCHITECTURE (EA) EFFORTS AGAINST GAO'S EA MANAGEMENT MATURITY FRAMEWORK

Maturity Stage	GAO Core Element [16]	OMB Capability Area [17]	Description	Satisfied? (Yes, No, Partial) [18]
0	**Creating EA Awareness**			
1	**Establishing EA Institutional Commitment and Direction**			
	1	Use	Written and approved organization policy exists for EA development, maintenance, and use.	Partial
	2	Use	Executive committee representing the enterprise exists and is responsible and accountable for EA.	No
	3	Use	Executive committee is taking proactive steps to address EA cultural barriers.	Partial
	4	Use	Executive committee members are trained in EA principles and concepts.	No
	5	Use	Chief architect exists.	Partial
	6	Use	EA purpose is clearly stated.	No
	7	Use	EA framework(s) is adopted.	Yes
	8	Results	EA performance and accountability framework is established.	No
2	**Creating the Management Foundation for EA Development and Use**			
	9	Use	EA budgetary needs are justified and funded.	No
	10	Use	EA program office(s) exists.	No

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[16] GAO-10-846G

[17] This representation reflects the three capability areas that are provided for in OMB's EA Assessment Framework. As such, this representation demonstrates how GAO and OMB's EA frameworks are fundamentally aligned and substantially consistent. The three capability areas and OMB's definition of each are as follows: ***Completion:*** The extent to which an agency has developed an integrated, organization wide architecture, in terms of business, performance, data, services, technology, and security, as well as a comprehensive enterprise transition plan. ***Use:*** The extent to which the agency has established key management practices, processes, and policies needed for developing, maintaining, and overseeing its architecture, and for demonstrating both the importance of architecture awareness and the value of employing architecture practices; it also assesses the extent of the agency's use of its architecture to inform strategic planning, program performance improvement planning, information resources management, IT management, and capital planning and investment control processes. ***Results:*** The extent to which the agency is measuring the effectiveness and value of its architecture activities by assigning performance measurements to its architecture and related processes, and reporting on actual results to demonstrate architecture success.

[18] To determine the results, we aggregated our assessment of the DOT components' EA against GAO's core elements and OMB's capability areas.

Exhibit C. Assessment of DOT's Enterprise Architecture (EA) Efforts Against GAO's EA Management Maturity Framework

Maturity Stage	GAO Core Element [16]	OMB Capability Area [17]	Description	Satisfied? (Yes, No, Partial) [18]
	11	Use	Key program office leadership positions are filled.	No
	12	Use	Program office human capital plans exist.	No
	13	Use	EA development and maintenance methodology exists.	Partial
	14	Use	Automated EA tools exist.	Partial
	15	Use	EA program management plan exists and reflects relationships with other management disciplines.	Partial
	16	Use	Work breakdown structure and schedule to develop EA exist.	Partial
	17	Completion	EA segments, federation members, and/or extended members have been identified and prioritized.	Partial
	18	Results	Program office readiness is measured and reported.	No
3	**Developing Initial EA Versions**			
	19	Use	Organization business owner and CXO representatives are actively engaged in architecture development.	No
	20	Use	EA human capital plans are being implemented.	No
	21	Use	Program office contractor support needs are being met.	No
	22	Use	Program office staff are trained in EA framework, methodology, and tools.	No
	23	Use	Methodologies and tools exist to determine investment compliance with corporate and subordinate architectures.	No
	24	Use	Methodologies and tools exist to determine subordinate architecture alignment with the corporate EA.	No
	25	Use	EA-related risks are proactively identified, reported, and mitigated.	No
	26	Completion	Initial versions of corporate "as-is" and "to-be" EA and sequencing plan are being developed.	Partial
	27	Completion	Initial version of corporate EA describing the enterprise in terms of performance, business, data, services, technology, and security is being developed.	Partial
	28	Completion	One or more segment and/or federation member architectures are being developed.	Partial
	29	Completion	Architecture products are being	Yes

Exhibit C. Assessment of DOT's Enterprise Architecture (EA) Efforts Against GAO's EA Management Maturity Framework

Maturity Stage	GAO Core Element [16]	OMB Capability Area[17]	Description	Satisfied? (Yes, No, Partial)[18]
			developed according to the EA content framework.	
	30	Completion	Architecture products are being developed according to a defined EA methodology.	No
	31	Completion	Architecture products are being developed using EA tools	No
	32	Results	Architecture development progress is measured and reported.	No
4	**Completing and Using an Initial EA Version for Targeted Results**			
	33	Use	Executive committee has approved the initial version of corporate EA.	No
	34	Use	Key stakeholders have approved the current version of subordinate architectures.	No
	35	Use	EA is integral to the execution of other institutional management disciplines.	No
	36	Use	Program office human capital needs are met.	No
	37	Completion	Initial versions of corporate "as-is" and "to-be" EA and sequencing plan exist.	Partial
	38	Completion	Initial version of corporate EA captures performance, business, data, services, technology, and security views	No
	39	Completion	One or more segment and/or federation member architectures exist and are being implemented.	No
	40	Results	EA product quality is measured and reported.	No
	41	Results	EA results and outcomes are measured and reported.	No
	42	Results	Investment compliance with corporate and subordinate architectures is measured and reported.	No
	43	Results	Subordinate architecture alignment with the corporate EA is measured and reported.	No
5	**Expanding and Evolving the EA and Its Use for Institutional Transformation**			
	44	Use	Organization head has approved current version of the corporate EA.	No
	45	Use	Organization component heads or segment owners have approved current version of their respective subordinate architectures.	Partial
	46	Use	Integrated repository tools and common EA framework and	No

Exhibit C. Assessment of DOT's Enterprise Architecture (EA) Efforts Against GAO's EA Management Maturity Framework

Maturity Stage	GAO Core Element [16]	OMB Capability Area [17]	Description	Satisfied? (Yes, No, Partial) [18]
			methodology are used across the enterprise.	
	47	Use	Corporate and subordinate architecture program offices operate as a single virtual office that shares resources enterprisewide.	No
	48	Completion	Corporate EA and sequencing plan are enterprisewide in scope.	No
	49	Completion	Corporate EA and sequencing plan are aligned with subordinate architectures.	No
	50	Completion	All segment and/or federated architectures exist and are horizontally and vertically integrated	No
	51	Completion	Corporate and subordinate architectures are extended to align with external partner architectures.	No
	52	Results	EA products and management processes are subject to independent assessment.	No
6	**Continuously Improving the EA and Its Use to Achieve Corporate Optimization**			
	53	Use	EA is used by executive leadership to inform organization strategic planning and policy formulation.	No
	54	Use	EA human capital capabilities are continuously improved.	No
	55	Use	EA methodologies and tools are continuously improved.	No
	56	Use	EA management processes are continuously improved and reflect the results of external assessments.	No
	57	Completion	EA products are continuously improved and updated.	No
	58	Results	EA quality and results measurement methods are continuously improved.	No
	59	Results	EA continuous improvement efforts reflect the results of external assessments.	No

Source: OIG generated using GAO and OMB EA frameworks.

Exhibit C. Assessment of DOT's Enterprise Architecture (EA) Efforts Against GAO's EA Management Maturity Framework

EXHIBIT D. MAJOR CONTRIBUTORS TO THIS REPORT

Name	Title
Louis C. King	Former Program Director
Michael Marshlick	Project Manager
Martha Morrobel	Information Technology Specialist
Susan Neill	Writer-Editor

APPENDIX. AGENCY COMMENTS

Memorandum

U.S. Department of
Transportation
Office of the Secretary
of Transportation

Subject: **ACTION**: Management Response to Office of Inspector
General (OIG) Draft Report on Enterprise Architecture

Date: **MAR ? 1 2012**

From: Nitin Pradhan
Chief Information Officer

Reply to
Attn. of:

To: Louis King
Assistant Inspector General for Financial and
Information Technology Audits

DOT Refocusing Action on Enterprise Architecture

The Office of the Chief Information Officer (OCIO) is making substantive changes to
the enterprise architecture (EA) program in conjunction with ongoing enhancements in
the areas of Capital Planning & Investment Control (CPIC), and IT Governance. This
renewed focus is intended to provide compliance with the new EA direction the Office
of Management and Budget (OMB) is proposing and to address the issues identified in
the OIG draft report.

Specifically, OCIO has actions underway to realign architecture under the Office of the
Chief Technology Officer to bring together technical, data, enterprise and solutions
architectures under one umbrella and into a common architectural fabric. This action
is expected to benefit the development of all our systems as well and provide visibility
into opportunities to consolidate and rationalize the Department's IT portfolio. This
realignment, coupled with the tight integration of architecture with the Technology
Control Board (TCB) and the testing labs, will allow DOT to keep the target
architecture as the driving force behind future IT investment choices and influence
acquisition decisions.

Given the availability of a relatively fixed set of resources, these efforts to provide a structured portfolio management process will necessitate the use of resources that may have been used elsewhere, and will require the application of a prioritized approach to action on the OIG recommendations.

In order to offer transparency as to the priority OCIO is assigning to the OIG recommendations, we established the following:

- Ranking A: Recommendations will receive the highest priority and OCIO commits to work with the OAs to achieve the results.

- Ranking B: Recommendations will be evaluated for inclusion in upcoming budget cycles. Implementation will commence only when funding is secured.

- Ranking C: Based on the priority of compliance with direction from OMB, along with other priority use of funding and staffing, these actions would be addressed after priority A and B are completed or if there were an unexpected surfeit of funds.

RECOMMENDATIONS AND RESPONSE

Recommendation 1: Develop and/or revise the Department's EA policy and procedures to address the following:

a. Development, maintenance, and use of EA in the IT investment process.

b. Incorporation of the Department's Governance groups into the CPIC and Enterprise Architecture processes to provide oversight and improved decision making relating to IT investments, including security funding.

c. Creation of a standardized methodology that provides reliable estimates of security funding needed for system investments.

d. Development and implementation of performance measures to gauge the Department's application of EA, including investments in system security.

e. Tracking and formal documentation of EA changes.

Response: Concur. OCIO will update the DOT overarching policy to:

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- Assert that the Federal Segment Architecture Methodology, Version 1.0 (FSAM v1.0) is the preferred architectural development methodology. This process will address items a, c, and e above, along with all appropriate requirements and guidance[19]. <u>These recommendations are considered priority ranking A and are intended to be completed by October 30, 2012.</u> With regard to item b, formally integrating the EA and CPIC programs, OCIO intends to incorporate a portfolio management approach in revising its policy. <u>This recommendation is considered priority ranking A and is intended to be completed by May 1, 2013.</u>

- With regard to item d, we consider the implementation measures of getting the policy and procedures in place to be the priority actions necessary to achieve compliance with the OMB requirements and to make significant headway on key issues identified by OIG. <u>As a result, at this time we consider creating performance measures to be a C level priority and would have to defer any commitment to implementation at this time to FY 2014 or FY 2015.</u>

Recommendation 2: Assist components in the selection and implementation of compatible EA tools that will facilitate the creation of a departmentwide EA.

Response: Concur. OCIO will request documentation for each current OA EA tool set and conduct an assessment to determine if one of the existing tools has the capability to support the entire Department. If we determine that none of the tools can be utilized for the entire Department, OCIO will conduct an analysis of available tools seek alternatives. <u>This recommendation is considered priority ranking A, and is intended to be completed by May 1, 2013.</u>

Recommendation 3: Input the required data (such as business processes, workflows, and technology in use) in the selected EA tools to develop or update current and future architectures and transition plans.

Response: Concur. As described above, adopting FSAM as the Department standard and assisting with the adoption compatible EA tools by all OAs will help address this finding. OCIO will also work with OST program offices and modal administrations to develop and maintain the Department's current state and proposed future state architectures and make appropriate changes as the target state evolves. The resulting EA models will be developed in an iterative manner, following FSAM best practices. <u>This recommendation is considered priority ranking B and will be evaluated for inclusion in the upcoming budget cycle but will not be implemented until funding is secured.</u>

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[19] The FSAM Web site (http://www.fsam.gov) provides guidance and templates for Enterprise Architects, CPIC Professionals, Security Professionals, Solution Architects, and Business Owners

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Recommendation 4: Develop and implement a departmentwide data management practice that provides a common data dictionary that reflects commonalities in data and processes and provide methods for sharing information across the Department.

Response: Concur in part. OCIO will evaluate alternative methods and best practices for data dictionaries and implement planning for a future build that will ultimately conform to the National Information Exchange Model (NIEM) standard. This will allow for an iterative adoption of standard data elements as the final solution is being implemented. This recommendation is considered priority ranking B and will be evaluated for inclusion in the upcoming budget cycle but will not be implemented until funding is secured.

Recommendation 5: Develop a process to measure components' EA programs' maturity and effectiveness using key framework elements outlined in OMB's Enterprise Architecture, and develop a plan to remediate any gaps, or deficiencies found.

Response: Concur in part. While OCIO recognizes the potential to improve measurement of OA EA efforts using established maturity models, such action is significantly lower priority than taking the actions necessary to implement consistent policy and procedures across the Department, to achieve compliance with OMB requirements. As a result, at this time we consider creating measures to be a C level priority and would have to defer any commitment to implementation at this time to FY 2014 or FY 2015.

Recommendation 6: Develop a plan and work with the components to identify redundancy in current operations and technology use across the Department.

Response: Concur. Redundancy can be eliminated at many layers of the IT portfolio, not solely at the IT system or application level. By implementing the EA standards from FSAM and leveraging the Integrated Planning and Project Management (IPPM) framework, the foundation will be established for progress in reducing duplication. In response to this recommendation, a plan will be developed to analyze the existing EA framework in a segmented review and identify similar OA systems to partner, share services, eliminate redundancy and leverage licensing agreements. This recommendation is considered priority ranking A, and is intended to be completed by May 1, 2013.

Recommendation 7: Identify and report EA performance measure results, outcomes and progress to DOT's Governance groups and decision makers to ensure that they

have the proper information to make EA and related information security decisions.

Response: Concur in part. As indicated in the response to Recommendation 5 above, while OCIO recognizes the potential to improve measurement of EA efforts, such action is a significantly lower priority than taking the actions necessary to implement consistent policy and procedures across the Department, to achieve compliance with OMB requirements. As a result, at this time we consider creating measures to be a C level priority and would have to defer any commitment to implementation at this time to FY 2014 or FY 2015.

Recommendation 8: Create a department wide EA that is consistent with OMB and GAO's frameworks and meets the requirements of the Clinger-Cohen Act.

Response: Concur. As stated above, OCIO is making a renewed commitment to have a department-wide enterprise architecture program that combines the disciplines of technical, data, solutions and enterprise architecture under a single division. This integration is expected to bring dramatic efficiencies to the current process. The OCIO commits to identifying the necessary tools and personnel necessary through realignment and to forming Integrated Program Teams (IPT) that include representation from all impacted OAs. This will ensure that the target architecture is built according to the Department's requirements.

The OCIO commits to producing an EA policy that complies with OMB's requirements in addition to addressing capital planning, new technologies, and streamlined service delivery to the OAs. This policy and improvements to the various elements of the program will be supported by a more robust governance process that is currently under development and review.

OCIO has many actions underway to support the IG's recommendations. An OCIO reorganization request is in process, policy elements have been drafted, and tools will be assessed as a part of the integrated program. All of these efforts will lead to a fully integrated program. This recommendation is considered priority ranking A, and is intended to be completed by May 13, 2013.

OCIO has designated the senior accountable official to be Larry Slaughter, Acting CTO, for all the recommendations above. He can be reached at Larry.Slaughter@dot.gov or 202-366-0132. All requests for information going forward should be addressed to Mr. Slaughter.

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