



July 2016

# IMMIGRATION BENEFITS SYSTEM

## U.S. Citizenship and Immigration Services Can Improve Program Management

Accessible Version

# GAO Highlights

Highlights of [GAO-16-467](#), a report to congressional requesters

## Why GAO Did This Study

Each year, USCIS processes millions of applications for persons seeking to study, work, visit, or live in the United States, and for persons seeking to become a U.S. citizen. In 2006, USCIS began the Transformation Program to enable electronic adjudication and case management tools that would allow users to apply and track their applications online. In 2012, to address performance concerns, USCIS changed its acquisition strategy to improve system development.

In May 2015, GAO reported that USCIS expected the program to cost up to \$3.1 billion and be fully operational by March 2019. This includes more than \$475 million that was invested in the initial version of the program's key case management component, USCIS ELIS, which has since been decommissioned.

This report evaluates the extent to which the program is using information technology program management leading practices. To perform this work, GAO identified agency policy and guidance and leading practices in, among other things, cost estimation, Agile software development, and systems integration and testing, and compared these with practices being used by the program.

## What GAO Recommends

GAO is making 12 recommendations to improve Transformation Program management, including ensuring alignment among policy, guidance, and leading practices in areas such as Agile software development and systems integration and testing. DHS concurred with the recommendations.

View [GAO-16-467](#). For more information, contact Carol C. Harris at (202) 512-4456 or [chac@gao.gov](mailto:chac@gao.gov).

July 2016

# IMMIGRATION BENEFITS SYSTEM

## U.S. Citizenship and Immigration Services Can Improve Program Management

### What GAO Found

U.S. Citizenship and Immigration Services (USCIS) created a reliable updated estimate to project the Transformation Program's cost, but has experienced program management challenges. In particular, the program's cost estimate was well-documented and substantially comprehensive, accurate, and credible. However, among other things, software development and systems integration and testing for USCIS's Electronic Immigration System (USCIS ELIS) have not consistently been managed in line with the program's policies and guidance or with leading practices.

Regarding software development, the Transformation Program has produced some software increments, but is not consistently following its own guidance and leading practices. The software development model (Agile) adopted by the USCIS Transformation Program in 2012 includes practices aimed at continuous, incremental release of segments of software. Important practices for Agile defined in program policies, guidance, and leading practices include ensuring that the software meets expectations prior to being deployed, teams adhere to development principles, and development outcomes are defined. The table below lists the program's status in addressing eight key Agile development practices. For example, the program has committed to a specific framework for software development, referred to as Scrum, but has deviated from the underlying practices and principles of this framework.

**Table: Implementation of Key Agile Practices for USCIS ELIS**

Practice	Rating
Completing planning for software releases prior to initiating development and ensuring software meets business expectations prior to deployment	partial
Adhering to the principles of the framework adopted for implementing Agile software development	partial
Defining and consistently executing appropriate roles and responsibilities for individuals responsible for development activities	partial
Identifying users of the system and involving them in release planning activities	partial
Writing user stories that identify user roles, include estimates of complexity, take no longer than one sprint to complete, and describe business value	partial
Prioritizing user stories to maximize the value of each development cycle	yes
Setting outcomes for Agile software development	no
Monitoring and reporting on program performance through the collection of reliable metrics	partial

Source: GAO analysis of USCIS documentation. | GAO-16-467.

The Transformation Program has established an environment that allows for effective systems integration and testing and has planned for and performed some system testing. However, the program needs to improve its approach to system testing to help ensure that USCIS ELIS meets its intended goals and is consistent with agency guidance and leading practices. Among other things, the program needs to improve testing of the software code that comprises USCIS ELIS and ensure its approaches to interoperability and end user testing, respectively, meet leading practices. Collectively, these limitations have contributed to issues with USCIS ELIS after new software is released into production.

---

# Contents

---

Letter	1
Background	4
USCIS Transformation Program Has Not Fully Implemented	
Leading IT Management Practices	21
Conclusions	43
Recommendations for Executive Action	44
Agency Comments and Our Evaluation	45

---

Appendix I: Objectives, Scope, and Methodology	48
Appendix II: Management of Agile Software Development for USCIS ELIS	63
Appendix III: Management of Systems Integration and Testing for USCIS ELIS	97
Appendix IV: USCIS ELIS Interfaces	113
Appendix V: Comments from the Department of Homeland Security	116
Appendix VI: GAO Contact and Staff Acknowledgments	122
Appendix VII: Accessible Data	123
Agency Comment Letter	123
Data Tables	128

---

Tables	
Table 1: Key Changes to the Transformation Program's Acquisition Strategy	10
Table 2: Key DHS Acquisition Documents Updated Prior to Re-Baseline of the USCIS Transformation Program	11
Table 3: Planned Product Lines by Release, as of February 2016	17
Table 4: Adherence to Key Agile Development Management Practices	23
Table 5: Adherence to Key Integration and Testing Practices	28
Table 6: Dollar Amount for USCIS Contractors for the Transformation Program, as reflected in the USCIS Transformation Program Acquisition Plan as of March 201558	
Table 7: Release Planning and Development Dates	65
Table 8: Planned versus Actual Release Cycles for Major Program Releases, as of April 2016	92

---

Table 9: Transformation Program Sub-Features Delivered by Near-Term Releases, as reported to DHS in February 201694	
Table 10: Summary of Management of Continuous Integration and Testing Tools and Practices	98
Table 11: USCIS ELIS End User Test Plan Evaluation	110
Table 12: USCIS ELIS End User Test Case Evaluation	111
Table 13: USCIS ELIS End User Test Summary Results Evaluation	111
Table 14: Interfaces Planned for USCIS ELIS	113
Accessible Text for Figure 2: Organizational Structure for the Office of Transformation Coordination	128
Accessible Text for Figure 3: Organizational Structure for the Office of Information Technology	129
Accessible Text for Figure 7: Traceability from Operational Requirements to User Stories	129

---

## Figures

Figure 1: USCIS Organizational Chart	5
Figure 2: Organizational Structure for the Office of Transformation Coordination	6
Figure 3: Organizational Structure for the Office of Information Technology	7
Figure 4: Planned Transformation Program Benefit Application and Adjudication Process (simplified)	9
Figure 5: Comparison of Agile and Waterfall Software Development	13
Figure 6: USCIS Process for Agile Software Development	15
Figure 7: Traceability from Operational Requirements to User Stories	16
Figure 8: Scrum Process for USCIS ELIS Release Process	71
Figure 9: Continuous Integration Build Process for USCIS ELIS	99
Figure 10: Unit and Integration Testing Process	101



---

---

## Abbreviations

CIO	Chief Information Officer
COR	contracting officer's representative
DHS	Department of Homeland Security
ELIS	Electronic Immigration System
FADS	Flexible Agile Development Services
IT	information technology
OIT	Office of Information Technology
OTC	Office of Transformation Coordination
USCIS	U.S. Citizenship and Immigration Services

This is a work of the U.S. government and is not subject to copyright protection in the United States. The published product may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.



July 7, 2016

Congressional Requesters

Each year, the Department of Homeland Security's (DHS) U.S. Citizenship and Immigration Services (USCIS) processes millions of applications for more than 50 types of immigrant and nonimmigrant-related benefits for persons seeking to study, work, visit, or live in the United States, and for persons seeking to become a U.S. citizen.<sup>1</sup> Having a system to facilitate the processing of immigration benefits and citizenship applications in a timely manner and identify fraudulent and criminal activity is essential for ensuring the integrity of the immigration process.

We have previously reported<sup>2</sup> on inefficiencies in USCIS's current benefits processing systems. These systems employ both electronic and paper records, and therefore make sharing the information with other government agencies (such as those for monitoring criminal or terrorist activity) difficult and time-consuming.

---

<sup>1</sup>Immigrant benefits are for foreign nationals (citizens of another country) who seek to live or work in the United States permanently. Nonimmigrant benefits are for individuals seeking to enter the United States for a specific purpose, such as tourism or temporary employment. Citizenship benefits can be granted to a noncitizen who meets certain eligibility requirements and seeks to become a United States citizen. Humanitarian benefits are for persons who are brought to the United States or are currently in the United States and who are fleeing persecution, require temporary protection from removal, or need an extended stay due to emergent circumstances (e.g., those placed in temporary protected status, seeking asylum or entering as a refugee, or granted significant public benefit parole) as a form of humanitarian aid, such as people in need of shelter or aid from disaster, oppression, or other specific circumstances.

<sup>2</sup>GAO, *Asylum: Additional Actions Needed to Assess and Address Fraud Risks*, [GAO-16-50](#) (Washington, D.C.: Dec. 2, 2015); *Immigrant Investor Program: Additional Actions Needed to Better Assess Fraud Risks and Report Economic Benefits*, [GAO-15-696](#) (Washington, D.C.: Aug. 12, 2015); *Immigration Benefits System: Better Informed Decision Making Needed on Transformation Program*, [GAO-15-415](#) (Washington, D.C.: May 18, 2015); *Immigration Benefits: Improvements Needed to Fully Implement the International Marriage Broker Regulation Act*, [GAO-15-3](#) (Washington, D.C.: Dec. 10, 2014); and *H-1B Visa Program: Reforms Are Needed to Minimize the Risks and Costs of the Current Program*, [GAO-11-26](#) (Washington, D.C.: Jan. 14, 2011).

---

In 2006, USCIS embarked on a major initiative—the Transformation Program—to enable electronic adjudication and case management tools that would allow applicants to apply and track the progress of their application online. USCIS planned to complete this initial effort no later than June 2014 at a cost of up to \$2.1 billion. In May 2015, we reported that USCIS expected the program to cost up to \$3.1 billion and be fully operational no later than March 2019.<sup>3</sup> The program reported expenditures of nearly \$1.2 billion (in then-year dollars) through the end of fiscal year 2014. Since that time, the program’s monthly performance reports to DHS reported additional expenditures of \$192 million through February 2016.

According to USCIS, as of April 2016, the program had deployed functionality to support the processing of approximately 2.3 of the 7.3 million applications processed by USCIS each year, or about 31% of the total workload. The USCIS Electronic Immigration System (USCIS ELIS) is the main component of the Transformation Program.

You asked us to examine USCIS’s effort to modernize its paper-based application, case management, and adjudication systems and processes. Our objective was to assess the extent to which the USCIS Transformation Program is using information technology (IT) program management leading practices. To do so, we assessed the extent to which USCIS is implementing Agile software development<sup>4</sup> for USCIS ELIS; adhering to leading practices and agency guidance<sup>5</sup> in system integration and testing; following leading practices in monitoring the largest Transformation Program contractors; and developing a life cycle cost estimate for the Transformation Program consistent with our cost estimating guidance.

---

<sup>3</sup>[GAO-15-415](#).

<sup>4</sup>Agile software development calls for delivering software in small, short increments rather than in the typically long, sequential phases used in a traditional waterfall approach. More a philosophy than a methodology, Agile emphasizes early and continuous software delivery, as well as using collaborative teams and measuring progress with working software.

<sup>5</sup>For the purposes of this report, guidance refers to a variety of USCIS and program-level documentation, such as plans, guidelines, and team artifacts.

---

To assess the extent to which the program is implementing Agile software development and is adhering to leading practices and agency guidance in system integration and testing, we identified applicable leading practices and program policies and guidance. Based on this information, we identified eight practices for Agile software development and three practices for system integration and testing. We then reviewed relevant plans and program documentation and interviewed USCIS staff and determined the extent to which the program addressed the practices.

To assess the extent to which the program followed leading practices in monitoring its largest contractors, we selected the two largest contracts managed by the Office of Transformation Coordination (OTC) and the four largest contracts managed by the USCIS Office of Information Technology (OIT). We also identified four practices based on applicable department and agency policies and procedures and leading practices. We then reviewed relevant plans and contract documentation, such as monthly performance statements and contract deliverables, and interviewed USCIS staff and determined the extent to which the program addressed the key practice areas.

To examine the extent to which the cost estimate for the program was consistent with leading practices, we relied on the leading practices contained in GAO's *Cost Estimating and Assessment Guide*.<sup>6</sup> We obtained and reviewed documentation and met with key program officials and evaluated the program's practices relative to our cost guide.

We conducted this performance audit from May 2015 to July 2016, 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. More details about the objectives, scope, and methodology can be found in appendix I.

---

<sup>6</sup>GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, [GAO-09-3SP](#) (Washington, D.C., March 2009).

---

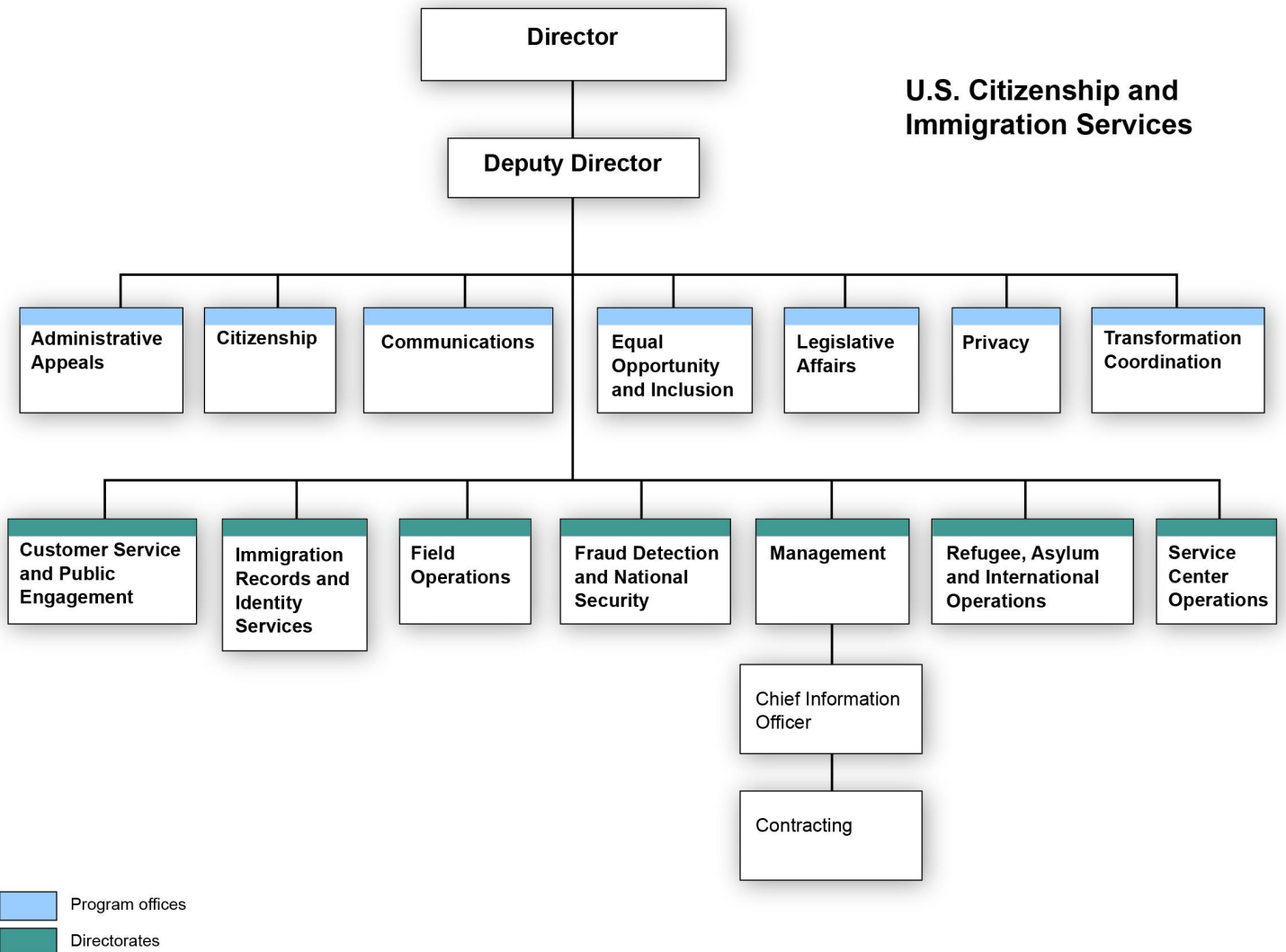
---

## Background

USCIS' mission is to provide accurate and useful information to its applicants, adjudicate immigration and U.S. citizenship benefits, promote an awareness and understanding of citizenship, and ensure the integrity of the immigration system. According to DHS, on an average day, USCIS completes 23,000 applications for various immigration benefits; welcomes 3,200 new citizens; answers 44,000 phone calls to its toll-free customer service line; serves 9,500 customers at 84 local offices; fingerprints and photographs 15,000 applicants at 136 application support centers; conducts 148,000 national security background checks; and processes 2,040 petitions filed by employers to bring foreign national workers to the United States.

To administer its mission, USCIS is divided into directorates and program offices. Directorates are director-led departments in charge of multiple divisions. Program offices have a specific function and are led by a chief. Figure 1 provides an overview of the USCIS organizational structure.

Figure 1: USCIS Organizational Chart



Source: GAO analysis of U.S. Citizenship and Immigration Services documentation. | GAO-16-467

OTC manages and oversees the development of USCIS ELIS, the account-based system that allows electronic submission, tracking, and

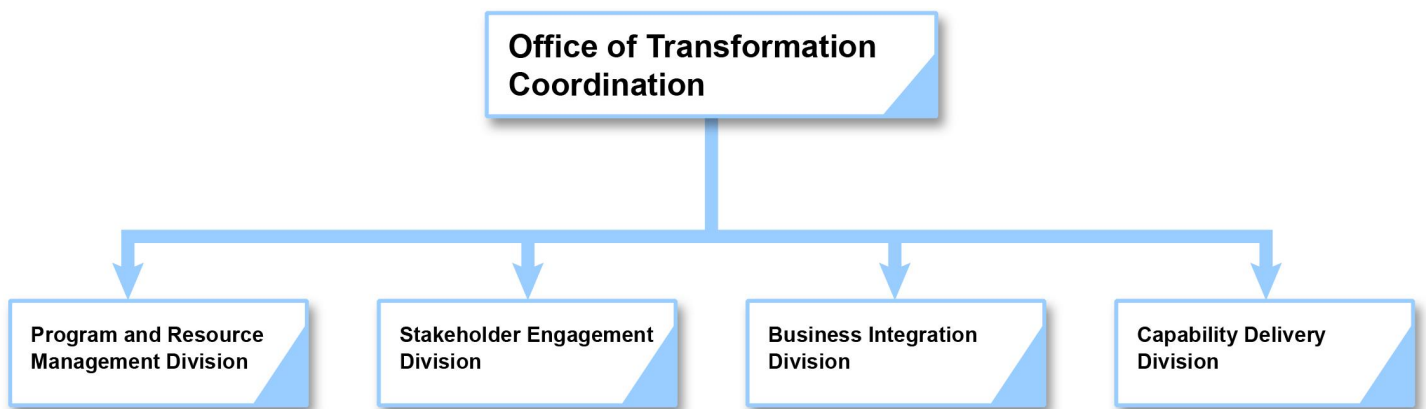
---

viewing of case status updates. OTC is supported in managing and overseeing the larger USCIS Transformation Program by other USCIS directorates and program offices, including OIT and the Customer Service and Public Engagement directorate.<sup>7</sup>

OTC is composed of four divisions: Business Integration, Stakeholder Engagement, Program and Resource Management, and Capability Delivery. Figure 2 provides an overview of the OTC organizational structure.

---

**Figure 2: Organizational Structure for the Office of Transformation Coordination**



Source: GAO analysis of U.S. Citizenship and Immigration Services documentation. | GAO-16-467

OIT is composed of six divisions. Within these, the Applied Technology Division is further made up of five branches: Strategic Vendor Management, Architecture, Delivery Assurance, Program Support, and Agile Coaching and Testing. In particular,

The Delivery Assurance branch is expected to support software application development, such as USCIS ELIS and supporting systems,

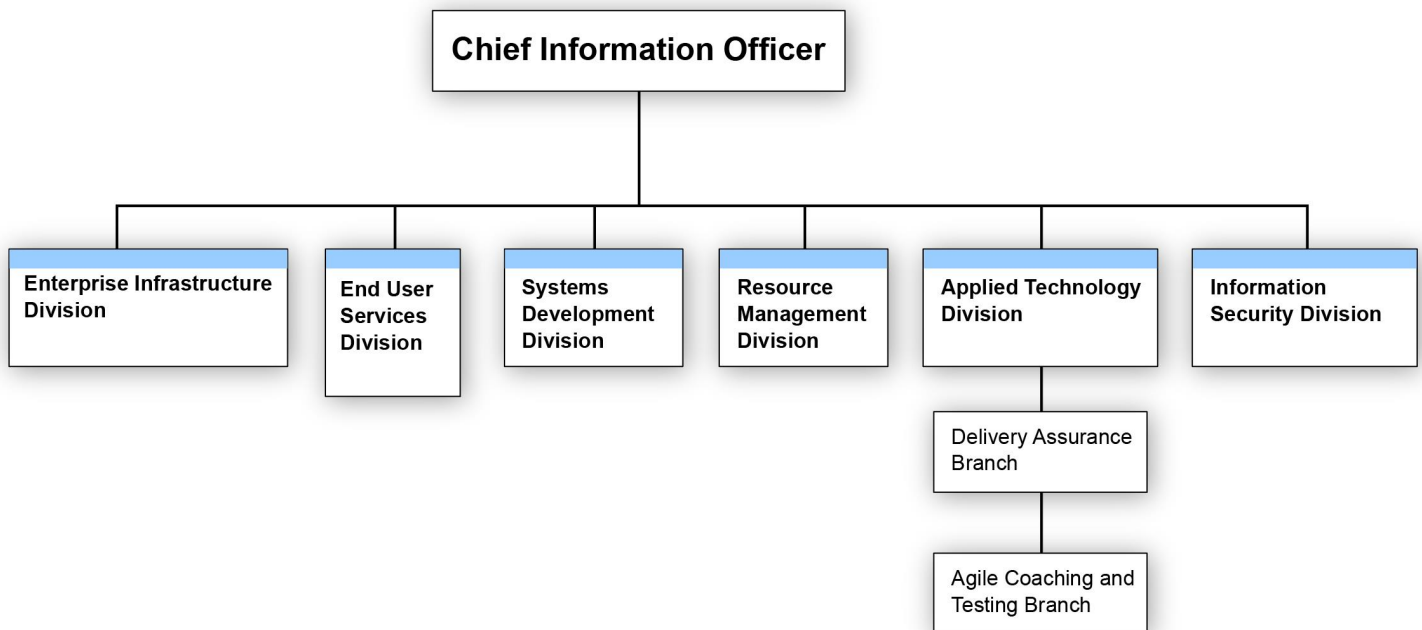
---

<sup>7</sup>According to the Chief of OTC, the Customer Service and Public Engagement Directorate is responsible for myUSCIS, which will provide a public interface to USCIS ELIS.

along with infrastructure upgrades through, among other things, quality assurance and software release management.

The Agile Coaching and Testing branch is expected to provide support to USCIS by establishing and monitoring an automated test framework that allows for continuous delivery of software capabilities and providing coaching for development and business teams. As part of its coaching responsibilities, this branch supports project teams with identification of Agile engineering best practices and methodologies, and promotes use of such practices. Figure 3 provides an overview of the OIT organizational structure.

Figure 3: Organizational Structure for the Office of Information Technology



Source: GAO analysis of U.S. Citizenship and Immigration Services documentation. | GAO-16-467

## USCIS Intends to Modernize Immigration Benefits and Adjudication Processing

The goals of the Transformation Program are to modernize the paper-based immigration benefits process, enhance national security and system integrity, and improve customer service and operational efficiency. Established in 2006, the program comprises many systems, each of which provides a service to facilitate operations, such as identity management and risk and fraud analytics. The objectives of the Transformation Program are to allow



- 
- applicants to establish an account with USCIS to file and track the status of the application, petition, or request online;
  - USCIS ELIS to apply risk-based rules automatically to incoming applications, petitions, and requests to identify potentially fraudulent applications and national security risks;
  - adjudicators to have electronic access to applications, petitions, and requests, relevant policies and procedures, and external databases;
  - USCIS to have management information to track and allocate workload; and
  - USCIS ELIS to have electronic linkages to other agencies, such as the Departments of Justice and State, for data sharing and security purposes.

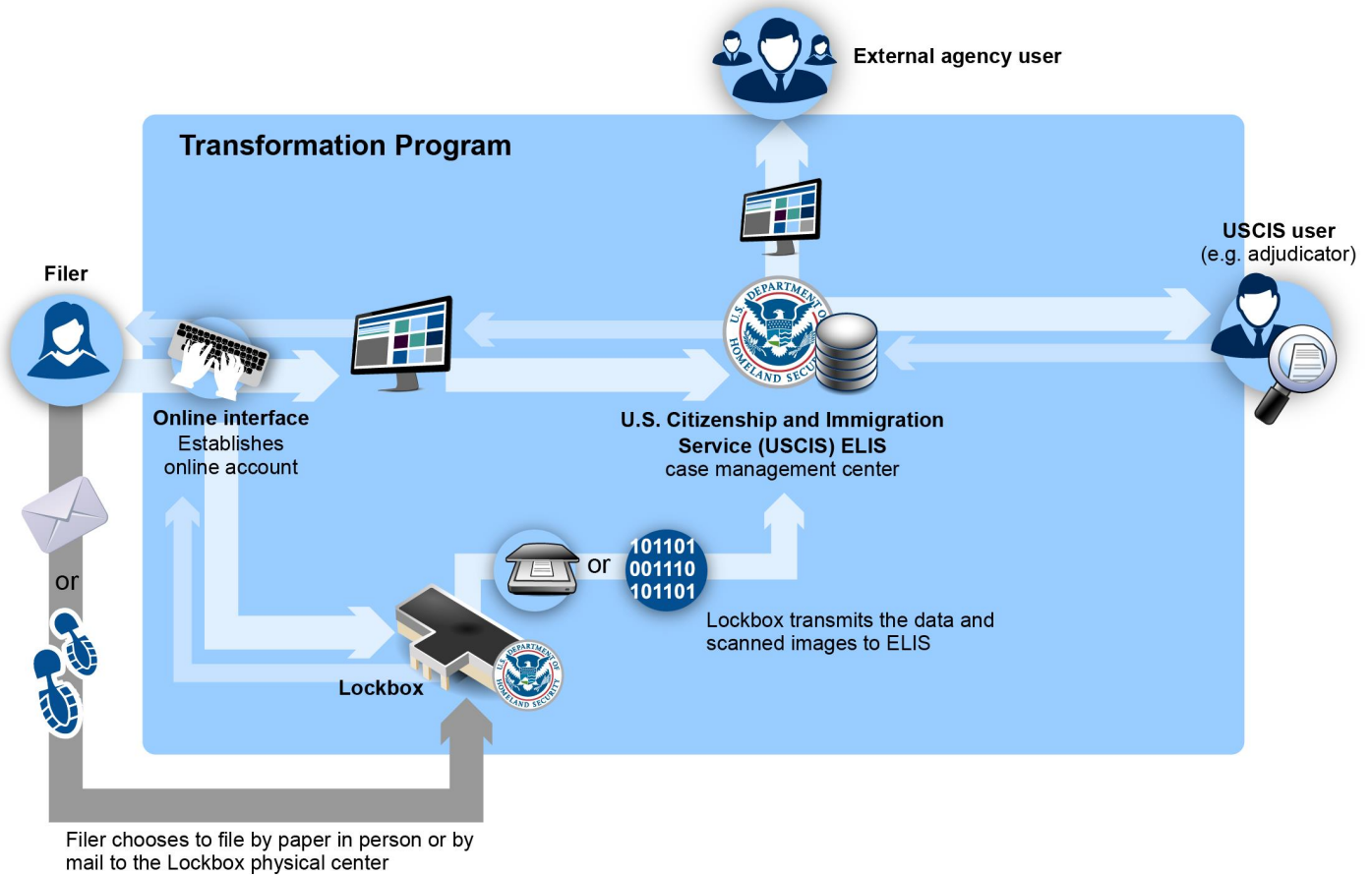
The main component of the program is USCIS ELIS, which is to provide case management for adjudicating immigration benefits. USCIS ELIS relies on and interfaces with other systems that provide additional capabilities, such as user authentication and scheduling, to deliver end-to-end processing. Applications are ingested into the system either through the Lockbox<sup>8</sup> for paper applications, or an online interface<sup>9</sup> for electronic applications. Figure 4 provides a simplified depiction of the steps involved in the filing and processing of immigration benefits and citizenship applications under the Transformation Program.

---

<sup>8</sup>Historically, USCIS has required applicants, petitioners, or benefit requestors to submit a paper submission for immigration applications, petitions, or benefit requests to one of its Lockbox facilities. Lockbox facilities are operated by U.S. Department of Treasury financial agents on behalf of USCIS to receive paper requests, process payments, and forward the requests to USCIS Service Centers in paper and electronic format for further processing. As USCIS ELIS expands to new immigration benefit types, the applicable Lockbox facility will adjust its legacy delivery process to transmit filings to USCIS ELIS rather than to the legacy system. It will transmit the data to USCIS ELIS and the scanned images of the paper filings to USCIS ELIS electronic storage.

<sup>9</sup>Recently, the program pursued development of a new external customer interface called myUSCIS, which is intended to allow customers to directly file applications for immigration benefits electronically and access an online account to view their case status, receive updates and notices from USCIS, and communicate online with USCIS for assistance with or information about their cases. It is managed by the Customer Service and Public Engagement Directorate within USCIS, which is separate from OTC.

Figure 4: Planned Transformation Program Benefit Application and Adjudication Process (simplified)



Source: GAO analysis of U.S. Citizenship and Immigration Services documentation. | GAO-16-467

## Transformation Program Has Experienced Key Changes

In November 2008, USCIS awarded a solutions architect contract to International Business Machines Corporation for approximately \$500 million to be allocated over a 5-year period to design, develop, test, deploy, and sustain the Transformation Program by November 2013. In July 2011, DHS officially approved the Transformation Program's acquisition program baseline. The baseline estimate was for about \$2.1 billion and projected that the program would reach full operating capability no later than June 2014.

An initial version of USCIS ELIS was launched in May 2012. This release included capabilities associated with all of the core operational requirements for the processing of non-immigrant requests to change or

---

extend status, such as online account setup, case management, case acceptance, applicant evidence intake, and notice generation.

However, leading up to and following deployment, the program office encountered a number of challenges with the system. For example, according to the program acquisition plan, automation of policies, rules, and processes for decision making were later determined to not be necessary or cost effective to maintain in the long term; the program had used a development approach that did not allow problems to show up early enough in the process to remedy; and the system was overly complex.

As a result, beginning in 2012, major changes were made to the Transformation Program's acquisition strategy. While transitioning to the new strategy, USCIS continued to fund development and enhancement of the legacy USCIS ELIS. Changes in the acquisition strategy are summarized in table 1.

---

**Table 1: Key Changes to the Transformation Program's Acquisition Strategy**

<b>Key change</b>	<b>Previous approach</b>	<b>New approach</b>
Contracting approach	One contractor that served as the sole solution architect and system integrator.	Multiple contractors to provide various services, with USCIS serving as the system integrator.
Software development approach	Waterfall development, an approach that uses long, sequential phases, resulting in product delivery years after program initiation.	Agile software development, an approach that delivers software in small, short increments, resulting in software released in phases.
Program architecture	Included a large number of proprietary commercial off-the-shelf software products, which are ready-made and available for sale.	Includes open source software, which is publicly available for use, study, reuse, modification, enhancement, and redistribution by the software's users. This software is to be used in combination with fewer commercial off-the-shelf products in a cloud computing environment.

Source: GAO-15-415. | GAO-16-467

In April 2015, USCIS updated the acquisition program baseline to reflect changes in the underlying acquisition strategy. This new baseline shows

a cost of no more than \$3.1 billion<sup>10</sup> and full operating capability no later than March 2019. As a result of these changes, the program office determined that it could no longer maintain the original USCIS ELIS system deployed in May 2012, and reported that it had been decommissioned in April 2016, even after having invested more than \$475 million in its development.

As part of the re-baseline, the program also updated supporting documentation.<sup>11</sup> Table 2 lists the acquisition documents that were updated prior to re-baseline approval from DHS and the purpose of each document.

**Table 2: Key DHS Acquisition Documents Updated Prior to Re-Baseline of the USCIS Transformation Program**

Document	Purpose
Life cycle cost estimate	Provides an exhaustive and structured accounting of all resources and associated cost elements required to develop, produce, deploy, and sustain a particular program.
Test and evaluation master plan	Documents the overarching test and evaluation approach for the acquisition program. Describes the developmental and operational test and evaluation needed to determine a system's technical performance, operational effectiveness/suitability, and limitations.
Acquisition plan	Provides a top-level plan for the overall acquisition approach. Describes why the solution is in the government's best interest and why it is the most likely to succeed in delivering capabilities to operators.
Operational requirements document	Provides a number of performance parameters that must be met by a program to provide useful capability to the operator by closing the capability gaps identified in the mission need statement.
Integrated logistics support plan	Defines the strategy for ensuring the supportability and sustainability of a future capability. Provides critical insight into the approach, schedule, and funding requirements for integrating supportability requirements into the systems engineering process.

<sup>10</sup>The program baseline approved in 2011 was based on costs from fiscal year 2006 to fiscal year 2022. The program baseline approved in April 2015 was based on costs from fiscal years 2006 to 2033. According to the baseline documentation, these additional years contribute about \$500 million (then-year) to the program's anticipated costs.

<sup>11</sup>As part of the re-baseline, the program updated the *USCIS Office of Transformation Coordination Lifecycle Cost Estimate*, *USCIS Transformation Program Test and Evaluation Master Plan: Electronic Immigration System*, *Office of Transformation Coordination Program Acquisition Plan Update*, *USCIS Transformation Program Operational Requirements Document*, and *USCIS Transformation Program Integrated Logistics Support Plan*. It also created the *USCIS Transformation Program System Engineering Life Cycle Tailoring Plan*.

Document	Purpose
Systems engineering life cycle tailoring plan	Documents the selection of the applicable development methodology and applicable tailoring of the systems engineering life cycle activities, artifacts, and reviews based on the specific characteristics of the program/project. Represents the agreement between the program/project and applicable decision authorities concerning the basic technical approach for the project.

Source: GAO analysis of USCIS documentation and DHS policy. | GAO-16-467

## USCIS Is Developing Its Transformation Program Incrementally

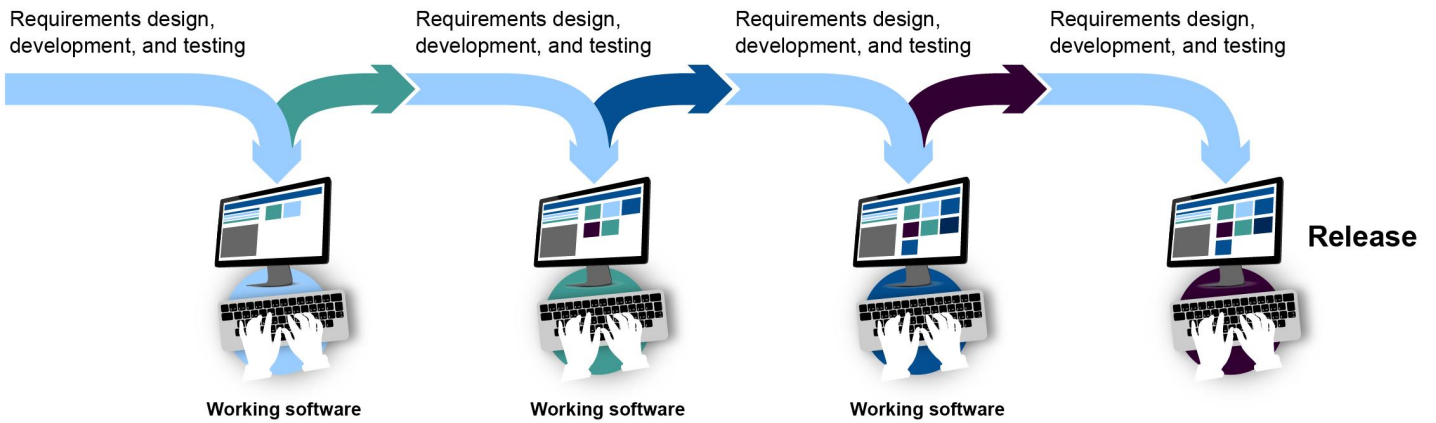
USCIS transitioned its approach to software development from waterfall development and is now using an incremental software development approach to develop, test, and deliver USCIS ELIS functionality to its users. Such an approach is consistent with OMB's *IT Reform Plan*<sup>12</sup> and the law commonly referred to as the *Federal IT Acquisition Reform Act*.<sup>13</sup> The incremental approach chosen by USCIS, called Agile, allows subject matter experts to validate requirements, processes, and system functionality in increments, and deliver the functionality to users in shorter cycles. See figure 5 for a depiction of software development using the Agile approach compared to a waterfall approach.

<sup>12</sup>OMB, *25 Point Implementation Plan to Reform Federal Information Technology Management* (Washington, D.C.: Dec. 9, 2010).

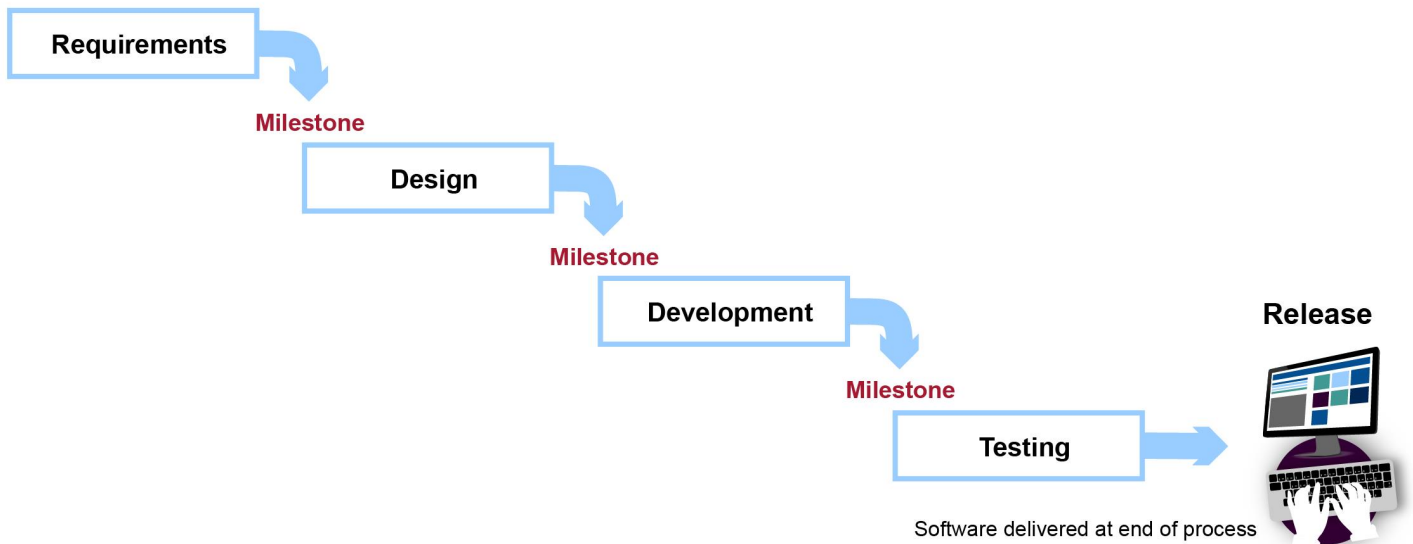
<sup>13</sup>40 U.S.C. § 11319(b)(1)(B)(ii). The *Federal Information Technology Reform provisions of the Carl Levin and Howard P. 'Buck' McKeon National Defense Authorization Act for Fiscal Year 2015*, Pub. L. No. 113-291, div. A, title VIII, subtitle D, 128 Stat. 3292, 3438-3450 (Dec. 19, 2014) are commonly referred to as the *Federal IT Acquisition Reform Act*.

Figure 5: Comparison of Agile and Waterfall Software Development

**A: Agile iterations**



**B: Waterfall phases**



Source: GAO analysis of U.S. Citizenship and Immigration Services documentation. | GAO-16-467

The Agile approach emphasizes early and continuous software delivery, the use of collaborative teams, and measurement of progress by the development of software in increments.

---

USCIS policy<sup>14</sup> defines various stages by which programs plan for, develop, and deploy a release. In preparation for a release, a program is expected to undergo a release planning phase that includes a release planning review. The release planning review allows the USCIS Chief Information Officer (CIO) or a designee to assess the project team's readiness to proceed with the release cycle based on whether the investment is justified by the expected results. After approval from this official, the project then proceeds to development activities. Development takes place in iterations, whereby a development team delivers a piece of functionality with each iteration. Collectively, these iterations will comprise the capabilities or features committed to in the release planning review, or a revised set of capabilities if priorities shift during the release.

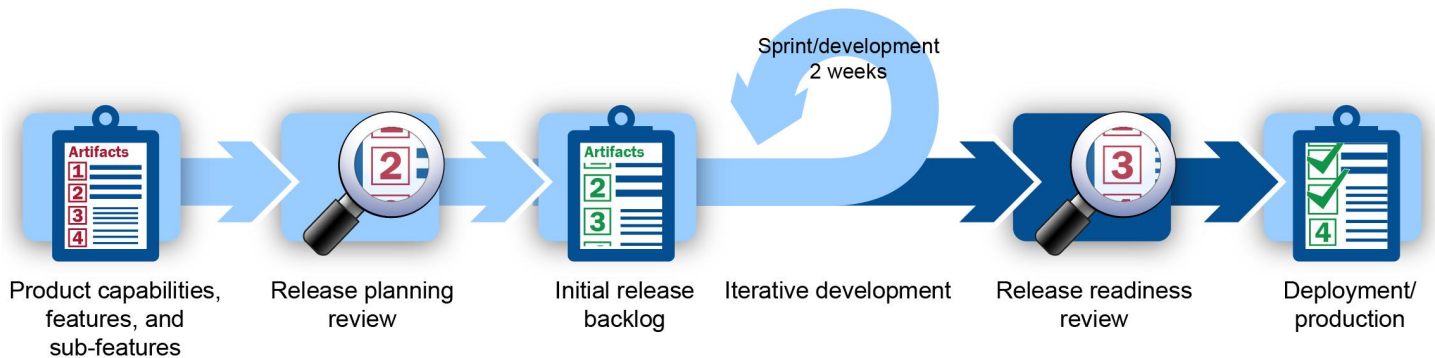
Once the program has determined that all of the needed functionality has been developed, the release undergoes a release readiness phase, which includes a release readiness review. The release readiness review allows the USCIS CIO or a designee to assess whether the current increment is ready to be deployed based on whether the release has been adequately tested, reviewed by the product owner and users, and is compliant with internal standards. The official approving the release is to verify that release activities have been coordinated and determine whether USCIS is prepared for the impact of the release, among other things. After obtaining approval, the release is then deployed and becomes accessible both to internal USCIS users responsible for processing of applications, such as an adjudicator, and customers outside USCIS, such as applicants or Department of State officials with access permission.<sup>15</sup> Figure 6 depicts the Agile software development cycle within USCIS.

---

<sup>14</sup>USCIS, *Management Instruction CIS-OIT-001, Office of Information Technology: Agile Development Policy* (Apr. 10, 2013).

<sup>15</sup>Federal partners and other DHS components obtain information from USCIS ELIS through the Enterprise Service Bus Person Centric Query System.

Figure 6: USCIS Process for Agile Software Development



Source: GAO analysis of U.S. Citizenship and Immigration Services documentation. | GAO-16-467

To help guide its system development efforts, OTC updated and DHS approved the USCIS Transformation Program Operational Requirements Document in April 2015. This document identifies the program’s high-level objectives and intended outcomes in a set of five core operating requirements. The core program operating requirements are further described in terms of capabilities and features.<sup>16</sup> Capabilities plan to deliver business value over a number of releases, while features generally fulfill one or more stakeholder needs and are delivered within a release. Although not reflected in the operational requirements document, the program further decomposes features into a set of sub-features that are then elaborated on in a series of system or business requirements known as user stories.

As of February 2016, OTC reported that the five operating requirements are composed of 20 capabilities, 62 features, and 235 sub-features. This represents an overall decrease of 2 features and increase of 11 sub-

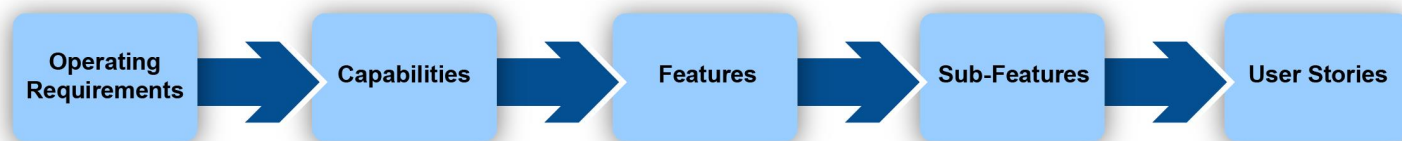
<sup>16</sup>The *Operational Requirements Document* defines requirements as long-term, portfolio-level initiatives that deliver Transformation across the enterprise (not limited solely to USCIS ELIS). It defines capabilities as groups of features that work together to deliver business value. Capabilities can span multiple releases and can involve multiple systems and organizations. It defines features as services provided by the system that fulfill a specific need and that can be developed (mostly) within a single system release.



---

features since OTC first began reporting this metric.<sup>17</sup> Figure 7 shows the relationship between the various levels of requirements by release.

**Figure 7: Traceability from Operational Requirements to User Stories**



Source: GAO analysis of U.S. Citizenship and Immigration Services documentation. | GAO-16-467

According to USCIS’s policy for Agile software development,<sup>18</sup> the Transformation Program, including USCIS ELIS, is to be developed and implemented in a series of releases that are to occur every 3-6 months. In addition to major releases, the Chief of OTC and USCIS CIO stated that the program deploys weekly minor releases into production. Minor releases are to enhance, or build on, existing product lines. To plan for and track development and delivery of prospective capabilities by release, the program created and regularly revises a program road map.

As shown in table 3, USCIS plans to deliver the program over a series of 16 releases, with each release generally corresponding to a new product line. As part of each release, USCIS ELIS is the primary focus, and other related systems are updated as needed. Each product line contributes to processing one of four lines of business.<sup>19</sup>

---

<sup>17</sup>As part of continuous monitoring since the program re-baseline, the Office of Transformation Coordination submits an agreed upon set of monthly metrics to the DHS Office of Program Accountability and Risk Management and the DHS Enterprise Business Management Office within the Office of the CIO. The program began including the number of capabilities, features, and sub-features as part of this presentation in September 2015.

<sup>18</sup>CIS-OIT-001.

<sup>19</sup>According to the Acquisition Plan, USCIS processes more than 50 types of benefit requests comprised of four lines of business, with approximately 15 product lines.

**Table 3: Planned Product Lines by Release, as of February 2016**

<b>Release</b>	<b>Product line</b>	<b>Line of business</b>
5.0.0	Permanent resident card (I-90 soft launch)	Immigrant
5.0.1	Permanent resident card (I-90 hard launch)	Immigrant
5.0.2	Permanent resident card (I-90 Lockbox)	Immigrant
5.1 (Rebuild)	Immigrant visa processing	Immigrant
6.1	Deferred action for childhood arrivals	Humanitarian
6.2	Temporary protected status	Humanitarian
7.1	Naturalization (N-400)	Citizenship
8.1	Citizenship	Citizenship
9.0	Family-based adjustment of status	Immigrant
10.0	Other (non-employment based) adjustment of status and EB-5	Immigrant
11.0	Employment-based adjustment of status	Immigrant
12.0	Employment-based nonimmigrants	Non-Immigrant
13.0	Employment-based nonimmigrants	Non-Immigrant
14.0	Refugee/asylum	Humanitarian
15.0	Miscellaneous	Humanitarian
16.0	International adoptions	Humanitarian

Source: Transformation Program Road Map. | GAO-16-467.

From May 2013 through November 2014, USCIS planned, developed, and deployed a temporary launch of the new USCIS ELIS to accommodate the limited processing<sup>20</sup> of one product line that processes the renewal and replacement of permanent resident cards.<sup>21</sup> This phase included development of core processing capabilities, such as the ability to electronically file or schedule appointments for the collection of

<sup>20</sup>The program permitted the public to file applications for a 72-hour period in November 2014. Between November 2014 and February 2015, the program processed applications submitted during the 72-hour period using the new USCIS ELIS. During this period, the program also continued developing additional functionality and addressing bugs or defects in the process. In February 2015, filing of I-90 applications via USCIS ELIS was made fully available to the public.

<sup>21</sup>Applicants file the I-90 form, "Application to Replace Permanent Resident Card," in order to replace a permanent resident card due to its being lost, stolen, destroyed, or meeting other conditions.

---

biometrics information. Development of this product line was completed and fully deployed in February 2015.

From February 2015 through the present, OTC has continued to add new functionality to USCIS ELIS, along with enhancements to existing functionality. For example, the program enhanced the functionality deployed in February 2015 by adding the ability to accept paper submissions for processing renewals and replacements of permanent resident cards through the Lockbox. The program also proceeded with new product lines that included parallel development of up to four product lines at once (releases 5.1, 6.1, 6.2, and 7.1). By March 2016, OTC had completed the roll out of two of these product lines (releases 5.1 and 6.1) to allow for processing of immigrant visa payments<sup>22</sup> and applications for deferred action for childhood arrivals.<sup>23</sup>

Subsequently, USCIS continued incremental system development and enhancement of USCIS ELIS with focus, in part, on processing applications for naturalization and temporary protected status.<sup>24</sup> According to the program road map, product lines deployed as of April 2016 (releases 5.0, 5.1, 6.1, and 7.1) represent approximately 2.3 million

---

<sup>22</sup>An individual seeking to immigrate to the United States as a lawful permanent resident must pay the \$165 USCIS immigrant fee online unless he/she meets certain exemption conditions. USCIS uses this fee to process an immigrant visa packet and produce a permanent resident card.

<sup>23</sup>On June 15, 2012, the Secretary of Homeland Security announced that certain people who came to the United States as children and met several key guidelines could request consideration of deferred action for a period of two years, subject to renewal, and would then be eligible for work authorization. Individuals who could demonstrate through verifiable documentation that they met these guidelines would be considered for deferred action. Determinations would be made on a case-by-case basis under the guidelines in the Secretary of Homeland Security's memorandum. In October 2015, the program made available limited processing of applications. Development of the product line was completed and fully available in February 2016.

<sup>24</sup>The Secretary of Homeland Security may designate a foreign country for temporary protected status due to conditions in the country that temporarily prevent the country's nationals from returning safely, or in certain circumstances, where the country is unable to handle the return of its nationals adequately. USCIS may grant temporary protected status to eligible nationals of certain countries (or parts of countries), who are already in the United States. Temporary protected status is a temporary benefit that does not lead to lawful permanent resident status or give any other immigration status.

---

of the 7.3 million applications processed each year, or approximately 31% of the total workload.

---

**Program Contract Management Responsibilities Are Shared Across USCIS**

USCIS assumed responsibility for managing multiple contractors as part of the Transformation Program's change in acquisition strategy. As part of this new approach, contract management responsibilities are shared between OTC and OIT for 12 active contracts:<sup>25</sup> seven to be managed by OIT, and 5 to be managed by OTC.<sup>26</sup>

Contract oversight is largely the responsibility of the contracting officer and contracting officer's representative (COR) assigned to a particular contract. The contracting officer has authority to enter into, administer, and terminate contracts and has the overall responsibility for ensuring the contractor complies with the terms of the contract. As part of his or her responsibilities, the contracting officer selects a COR, who assists in the technical monitoring and day-to-day administration of a contract.

Within DHS, the COR administers and directs daily operations within the scope of the contract, monitors contractor performance, ensures that requirements meet the terms of the contract, and partners with the Contracting Officer. The COR is authorized to monitor the contract on behalf of the Contracting Officer. However, the COR is not authorized to make any contractual commitments or changes that may affect the contract price, terms, or conditions without the approval of the Contracting Officer.

---

<sup>25</sup>Two additional contracts were active as of the date the Acquisition Plan was approved. These contracts provided continued development services until the Flexible Agile Development Services contract was awarded and independent verification and validation services.

<sup>26</sup>A number of additional contracts have since been awarded by USCIS in support of the Transformation Program. The acquisition plan does not reflect these new contracts nor has it been updated since approval in March 2015 to include these contracts.

---

GAO Has Previously  
Reported on  
Transformation Program

We have previously reported on the management and development of the USCIS Transformation Program. In July 2007,<sup>27</sup> we evaluated the Transformation Program's strategic and expenditure plans to determine the extent to which these plans had prepared USCIS to carry out its program. We reported that the agency's plans partially or fully addressed most key practices, but more attention was needed in certain areas such as performance measurement and IT management. We also reported that the plans provided some information on costs and revenues, but that USCIS had not finalized its acquisition strategy and, therefore, cost estimates were uncertain. To improve its strategy and to fully address congressionally requested information, we recommended that the Director of USCIS address gaps in plans in the areas of performance measurement, strategic human capital management, communications, and IT management practices. DHS concurred with our recommendations. Between September 2009 and September 2011, USCIS took steps to address the gaps identified in our report, such as finalizing a balanced set of four performance measures and establishing fiscal year 2012 targets that aligned with transformation goals for customer satisfaction, decisional accuracy, timeliness, and efficiency.

In November 2011,<sup>28</sup> we assessed the extent to which USCIS had followed DHS acquisition policy in developing and managing the Transformation Program. We reported that the agency had not consistently followed the acquisition management approach that DHS had outlined in management directives for developing and managing the program. For example, USCIS did not complete several acquisition planning documents required by DHS policy prior to moving forward with an acquisition approach, which contributed to schedule delays and increased program costs. To help ensure that USCIS used a comprehensive and cost-effective approach to the development and deployment of transformation efforts to meet the agency's goals of improved adjudication and customer services processes, we recommended that the Director of USCIS develop and maintain an

---

<sup>27</sup>GAO, *USCIS Transformation: Improvements to Performance, Human Capital, and Information Technology Management Needed as Modernization Proceeds*, [GAO-07-1013R](#) (Washington, D.C.: July 17, 2007).

<sup>28</sup>GAO, *Immigration Benefits: Consistent Adherence to DHS's Acquisition Policy Could Help Improve Transformation Program Outcomes*, [GAO-12-66](#) (Washington, D.C.: Nov. 22, 2011).

---

integrated master schedule consistent with leading practices for the Transformation Program and ensure that the life-cycle cost estimate be informed by milestones and associated tasks from reliable schedules. Between November 2011 and May 2016, USCIS took steps to address the gaps identified in our report, such as developing an integrated master schedule that was generally consistent with leading practices.

In May 2015,<sup>29</sup> we reviewed the Transformation Program's current status, including the impact of recent changes made, and assessed the extent to which DHS and USCIS are executing effective program oversight and governance. We noted that these changes have significantly delayed the program's planned schedule. We added that, while the program's two key governance bodies had taken actions aligned with leading IT management practices, neither had used reliable information to make decisions. To improve the ability of USCIS and DHS to monitor program performance, we recommended that these bodies use reliable information to inform their program evaluations. USCIS concurred with our recommendations and has begun work to address them.

---

## USCIS Transformation Program Has Not Fully Implemented Leading IT Management Practices

USCIS created a reliable updated estimate to project the program's cost but has experienced challenges in managing software development, testing, and contract management for USCIS ELIS, the key component of the program. In particular, software development, testing, and contract monitoring have not consistently been managed in line with the program's policies and guidance or with leading practices.

USCIS officials cited various reasons for the inconsistencies between program management activities and the practices described in program policies, guidance, and leading practices. For example, while USCIS documentation indicates that the program is being managed according to a software development framework that calls for development teams to follow specific practices, USCIS officials stated that the program is adjusting these practices based on lessons learned. However, the program is not ensuring that such changes are communicated broadly to development teams by updating its guidance to reflect these adjustments. These management weaknesses—which at times mirror those previously

---

<sup>29</sup> [GAO-15-415](#).

---

reported—increase the risk that the system will continue to exceed cost and schedule goals and that it may not meet performance expectations.

---

### Program Has Not Implemented Its Defined Software Development Approach Consistent with Its Policies and Associated Leading Practices

As noted, USCIS transitioned from a waterfall approach for software development to an Agile approach in order to increase the speed with which software is released into production and provide better control over each segment as it is released. Agencies can accomplish this objective by designing and implementing key management practices that are intended to maximize the value of software development and meet the values and principles of Agile software development. Based on the approach followed by the program, along with DHS and USCIS policy, procedures, and guidance<sup>30</sup> as well as leading practices,<sup>31</sup> key management practices for effective Agile software development include:

1. completing planning for software releases prior to initiating development and ensuring software meets business expectations prior to deployment;

---

<sup>30</sup>Department of Homeland Security, *Instruction Number: 102-01-004, Agile Development and Delivery for Information Technology, Revision #0* (Apr. 11, 2016); *Pre-Decisional Draft, DHS Agile Development Guidebook* (Sept. 2, 2014); *Draft, Agile Methodologies in DHS: Agile Working Group White Paper* (no date); U.S. Citizenship and Immigration Services, *Management Instruction CIS-OIT-001, Office of Information Technology: Agile Development Policy* (Apr. 10, 2013); *Agile Processes and Practices Principles and Guidelines, version 4.0* (Dec. 6, 2013); *USCIS Transformation Program: System Engineering Life Cycle Tailoring Plan, version 1.0* (March 2015); *USCIS ELIS Team Process Agreement for the April 7, 2015 to September 30, 2015 Development Period*; and *USCIS ELIS Team Process Agreement for the July 22, 2015 to January 30, 2016 Development Period*.

<sup>31</sup>GAO, *Software Development: Effective Practices and Federal Challenges in Applying Agile Methods*, [GAO-12-681](#) (Washington, D.C.: Jul. 27, 2012); Office of Management and Budget, U.S. Digital Services, *Playbook* (version pulled Dec. 18, 2015); *TechFAR: Handbook for Procuring Digital Services Using Agile Processes* (draft version pulled Nov. 6, 2014); Software Engineering Institute, *Agile Metrics: Progress Monitoring of Agile Contractors*, CMU/SEI-2013-TN-029 (Jan. 2014); *CMMI® for Development, Version 1.3*, CMU/SEI-2010-TR-033 (Nov. 2010); MITRE, *Defense Agile Acquisition Guide: Tailoring DoD IT Acquisition Program Structures and Processes to Rapidly Deliver Capabilities* (March 2014); *Handbook for Implementing Agile in Department of Defense Information Technology Acquisition* (Dec. 15, 2010); ISO/IEC/IEEE, *Systems and software engineering —Developing user documentation in an agile environment*, Corrected Version, ISO/IEC/IEEE 26515:2012(E) (Mar. 15, 2012); <http://agilemanifesto.org>; Ken Schwaber and Jeff Sutherland, *The Scrum Guide:™ The Definitive Guide to Scrum: The Rules of the Game* (Jul. 2013).

2. adhering to the principles of the framework adopted for implementing Agile software development;
3. defining and consistently executing appropriate roles and responsibilities for individuals responsible for development activities;
4. identifying users of the system and involving them in release planning activities;
5. writing user stories that identify user roles, include estimates of complexity, take no longer than one sprint to complete, and describe business value;
6. prioritizing user stories to maximize the value of each development cycle;
7. setting outcomes for Agile software development; and
8. monitoring and reporting on program performance through the collection of reliable metrics.

The program has defined and is at least partially adhering to most practices for effectively managing Agile software development in producing USCIS ELIS. However, the program is not fully adhering to most practices. Specifically, the program has fully implemented one key practice, partially implemented six practices, and did not implement the other practice. Table 4 describes the program’s adherence to these practices in developing USCIS ELIS. See appendix II for a more detailed analysis of each of the eight management practices.

**Table 4: Adherence to Key Agile Development Management Practices**

Key practice	Rating	Adherence to key practice
Completing planning for software releases prior to initiating development and ensuring software meets business expectations prior to deployment	partial	<p>The program created and provided evidence of having completed some aspects of planning for its software releases. For example, the program reviewed the core artifacts stipulated in USCIS policy in planning for each release of USCIS ELIS. These artifacts include a definition of the initial scope of the software release. The program also provided evidence that management discussed the work completed during the release and associated risks prior to deployment of each major release.</p> <p>However, the program did not complete other aspects of planning for its software releases. For example, the program did not provide evidence that the acquisition plan and program cost estimate were reviewed or updated as part of each release planning review. In addition, teams initiated development of major releases prior to completing planning for the release. Specifically, development across four of the five major releases began one week to one month prior to obtaining approval to complete release planning.</p> <p>The program also did not demonstrate that it took all planned steps for ensuring software meets business expectations prior to deploying software increments. For example, the program demonstrated that the USCIS CIO reviewed documents such as system design documentation as part of release readiness reviews. However, the</p>



Key practice	Rating	Adherence to key practice
		program did not demonstrate that other documents, such as automated and manual test scripts, were reviewed before the CIO approved individual releases.
Adhering to the principles of the framework adopted for implementing Agile software development	partial	<p>The program incorporated some of the principles of the Scrum framework, but did not follow others. For example, stakeholders were included in the sprint review and acceptance criteria was defined and discussed by the development team as part of sprint planning, as prescribed in the <i>Scrum Guide</i>.<sup>a</sup></p> <p>However, teams did not hold a retrospective meeting at the end of every sprint and, when held, development teams were not consistently implementing improvements identified during these retrospectives.</p>
Defining and consistently executing appropriate roles and responsibilities for individuals responsible for development activities	partial	<p>The program at times deviated from both the <i>Scrum Guide</i><sup>a</sup> and its internal management approach. The program's Scrum teams included both a product owner and development team, but did not include an individual explicitly designated to serve as a Scrum master. Moreover, one product owner was responsible for 12 development teams at one time during a release and another was responsible for 8 teams. This was in contrast to the program's management approach that limited product owner responsibility to 4 development teams or less.</p> <p>Following our discussions with OTC about product owner responsibilities, the program removed the 4-team restriction on the product owner and created a new position, product manager, to help the product owner in performing responsibilities. However, without also assuming the authority of the product owner, this new position adds an additional layer of communication and coordination, which may impact team performance.</p>
Identifying users of the system and involving them in release planning activities	partial	<p>The program has defined user roles within USCIS and roles associated with external customers. The program provided evidence that these USCIS users were involved in release planning and involvement of this group has increased over time. The program also provided additional evidence that external customers, while not involved in release planning, were included as part of ongoing planning and development efforts. For example, in October 2015, the program held two virtual focus groups to, among other things, understand customer perception of USCIS ELIS. However, the program did not identify users in external agencies, or other components within DHS, and did not include these users in release planning.</p>
Writing user stories that identify user roles, include estimates of complexity, take no longer than one sprint to complete, and describe business value	partial	<p>User stories we evaluated identified a user role and contained an estimate of complexity at least 90 percent of the time. However, of the approximately 1,000 user stories tracked by the Quality Assurance Team, over 30 percent took over a full sprint to develop. Further, most of the user stories did not define the associated business value.</p>
Prioritizing user stories to maximize the value of each development cycle	yes	<p>The backlogs for releases 6.1, 6.2, and 7.1 were ordered and clearly reflect the sprint in which a team expects to develop the story. According to the product owners for releases 6.1, 6.2, and 7.1, user story priorities are based on the need to develop specific features associated with an upcoming release.</p> <p>According to product owners, software development for multiple features occurs during each sprint. For example, a product owner might assign a development team some of the functionality associated with validating a customer identification number along with some functionality associated with scheduling a biometrics appointment during a single two-week development cycle. According to the product owners, work is organized in this fashion to address dependencies among features that impact the timing of needed functionality.</p>
Setting outcomes for Agile software development	no	The program has not established intended outcomes for Agile software development.

Key practice	Rating	Adherence to key practice
Monitoring and reporting on program performance through the collection of reliable metrics	partial	<p>Some metrics were reliable and addressed their intended purpose. For example, the program provided evidence of collecting reliable metrics associated with code quality. In addition, the program collects external customer satisfaction through a survey. The results from this survey are then reported to oversight bodies and in monthly program management review meetings.</p> <p>However, other metrics were either unreliable or were not collected. For example, the program does not monitor internal USCIS user satisfaction with USCIS ELIS. Therefore, it cannot measure the level of satisfaction of adjudicators or others using the system to facilitate the processing of applications. Moreover, metrics intended to demonstrate if the scope of each release is consistent with plans are not fully traceable back to the intended functionality.</p>

Source: GAO analysis of USCIS documentation. | GAO-16-467.

An element was determined to be a “no” if USCIS provided no evidence to satisfy any portion of the practice; “partial” if USCIS provided evidence that satisfied some, but not all, of the practice; and “yes” if USCIS provided evidence that it substantially satisfied all elements of the practice.

<sup>3</sup>Ken Schwaber and Jeff Sutherland, *The Scrum Guide:™ The Definitive Guide to Scrum: The Rules of the Game* (Jul. 2013).

The implementation of software development deviated from key practices in part because USCIS policy and guidance were not being updated to reflect changes in program implementation. For example, the USCIS CIO explained that, although policy requires a program to obtain approval for the scope of a release prior to proceeding with development, this is no longer the practice for the Transformation Program. Instead, approval is granted for six months of development and the scope of that approval is revisited as needed. Moreover, program-level procedures and assessments documented that teams committed to using the Scrum framework to guide their Agile development activities. Program officials stated that this framework is no longer followed as practices are continuously evolving to reflect lessons learned in each iteration. However, program-level procedures and assessments were not updated to reflect these changes.

In addition, based on our analysis, the program is not consistently following other key practices because USCIS policy and guidance do not align with leading practices. For example, policy, procedures, and guidance provided by the program do not define all of the key roles and responsibilities for developing USCIS ELIS. As a result, various individuals within the program reported different opinions about who was serving in critical roles, such as that of the Scrum master.

Further, controls were not always in place to ensure the program adhered to key practices. For example, we were unable to track monthly reports on program scope back to the associated release backlog. In a written

---

response, the Business Integration Division within OTC acknowledged issues in traceability of user stories to sub-features. This division stated that the process that was used to verify the number of sub-features implemented against planned was based on verbal confirmation from the product owner. The division subsequently determined that this process was not effective since it relied solely on the review of the user stories and was not as exact and reliable as expected. The division noted that requirements traceability is critical to avoid scope creep and to demonstrate that the user stories implemented addressed the mission needs.

Until the program addresses the key practices for Agile software development, it risks deploying a system that does not meet the cost, schedule, or performance needs of USCIS.

---

## Testing Efforts Are Not Fully Consistent with Agency Guidance or Leading Practices

In addition to management of Agile software development, a program needs to manage the quality of the software being developed through ongoing systems integration and testing. DHS and USCIS policy, procedures, and guidance,<sup>32</sup> as well as leading practices,<sup>33</sup> identify key management practices for systems integration and testing. These practices include:

1. establishing an environment and procedures for continuous integration<sup>34</sup> and testing of code;
2. performing continuous testing<sup>35</sup> through the use of

---

<sup>32</sup>Department of Homeland Security, *Pre-Decisional Draft, DHS Agile Development Guidebook* (Sept. 2, 2014); U.S. Citizenship and Immigration Services, *USCIS Test and Evaluation Master Plan: Electronic Immigration System, version 1.0* (February 2015); *USCIS ELIS Team Process Agreement for the April 7, 2015 to September 30, 2015 Development Period*; and *USCIS ELIS Team Process Agreement for the July 22, 2015 to January 30, 2016 Development Period; Agile Processes and Practices Principles and Guidelines, version 4.0* (Dec. 6, 2013); *USCIS Test Plan for Release 5.1-6.0* (10/15/2014-4/15/2015); *USCIS Test Plan* (updated July 2015).

<sup>33</sup>IEEE, *IEEE Standard 29119, Software and System Engineering – Software Testing, Part 1: Concepts and Definitions, Part 2: Test Process, Part 3: Test Documentation* (New York, NY, September 2013).

<sup>34</sup>Continuous integration is a practice of frequently merging an individual piece of software code with the main code repository, so new changes are tested continuously.

- 
- Unit tests: Small, automated tests used to verify that each individual unit of code written by the developer works as intended.
  - Integration tests: Tests that are intended to verify that individual modules or components function together as expected when combined.
  - Functional acceptance tests: Tests to verify that all user story acceptance criteria have been met and should be executed as capabilities are added or updated.
  - Code inspection: Process of inspecting code automatically and manually and comparing it to internal coding guidelines.
3. developing complete test plans and cases for interoperability and end user testing and documenting those results. Interoperability testing is an independent test in a production-like environment that is intended to verify the capability of system components and external work flows, communication, and information sharing in a controlled condition. The *USCIS Transformation Program Test and Evaluation Master Plan* requires execution of interoperability tests following any change to USCIS ELIS interfaces. End user testing is conducted to verify that business value is delivered and user story acceptance criteria are met. The *USCIS ELIS End User Test Strategic Plan* describes end user testing as involving USCIS ELIS users to test functionalities and usability using real-world scenarios prior to implementing a release into production.

The program has fully implemented one of these key practices and partially implemented the other two. Specifically, the program has established an environment and procedures for continuous integration and is conducting unit and integration, functional acceptance, interoperability, and end user tests, and code inspection.

However, the program is not consistently adhering to its policies and guidance or meeting benchmarks for unit and integration, and functional acceptance tests, and code inspection. Moreover, test plans, cases, and results were not fully developed for interoperability and end user testing.

---

<sup>35</sup>Continuous testing is a practice of testing software code throughout a sprint and providing feedback to the developers so that they can address issues and develop software that meets all required quality criteria. Using this approach, code is tested in various environments, from the development environment to a production-like environment.

Table 5 describes our findings in more detail. See appendix III for a more detailed analysis of each of the three key practices.

**Table 5: Adherence to Key Integration and Testing Practices**

Key practice	Rating	Adherence to key practice
Establishing an environment and procedures for continuous integration and testing of code	yes	The program has established an environment for continuous integration and testing for USCIS ELIS that is consistent with program planning documentation. For example, the program has created a process for the automated build of software code and automated testing of that code during the build process. This environment also includes configuration management, daily code integration, code build stops with test failure, and the capacity to provide rapid feedback on defects.
Performing continuous testing through the use of unit and integration tests, functional acceptance tests, and code inspection	partial	The program demonstrated that it conducted unit and integration testing, functional acceptance testing, and code inspection. However, the program did not demonstrate that it consistently met stated goals. For example, none of the internal applications that collectively make up USCIS ELIS have achieved 100 percent code coverage, which is the program's stated goal. In particular, agency reports show that internal application code coverage ranged from 31.2 percent to 96.9 percent. In addition, 63 of the 74 user stories we reviewed did not include evidence that functional acceptance tests were run and passed. Moreover, 13 of the 53 user stories we evaluated and to which peer inspection was applicable did not include evidence of peer inspection, which is an important component of inspecting code.
Developing complete test plans and cases for interoperability and end user testing and documenting those results	partial	The program developed nearly complete test plans and cases and documented the results for end user testing from June 2015 through March 2016. However, the program did not provide evidence of test plans, cases, or results for end user testing between March 2015 and June 2015 and the test plan is a draft document. Further, test plans and cases were not developed for interoperability testing, as the term is described in the USCIS <i>Transformation Program Test and Evaluation Master Plan</i> , and documentation of the results of such testing was incomplete.

Source: GAO analysis of USCIS documentation. | GAO-16-467.

An element was determined to be a "no" if USCIS provided no evidence to satisfy any portion of the practice; "partial" if USCIS provided evidence that satisfied some, but not all, of the practice; and "yes" if USCIS provided evidence that it substantially satisfied all elements of the practice.

The implementation of systems integration and testing deviated from key practices in part because policy and guidance were not being updated to reflect changes in the approach. For example, the program did not meet its stated goals for continuous testing because, according to the USCIS CIO, certain program goals are unrealistic. For example, the USCIS *Transformation Program Test and Evaluation Master Plan* stated that unit tests will reach 100% code coverage for the individual developed units. However, a member of the U.S. Digital Services team who is assisting the program stated that he and others conducting testing were unaware of the plan and that information contained in the plan does not reflect the practice of USCIS ELIS testers. Moreover, this individual agreed with the

---

USCIS CIO's assessment that the goal of 100% code coverage is unrealistic.

In addition, the program did not always have controls in place to ensure developers adhered to policy and guidance. For example, before a developer can integrate code with that of other developers or development teams, peer inspection by another individual is expected to occur to help ensure that the code meets program standards. However, the program has not established controls to monitor the extent to which peer inspection occurs.

Further, program policy and guidance did not always align with best practices in systems integration and testing. For example, with respect to interoperability and end user testing, these tests are performed outside of the continuous integration pipeline and are therefore not automated. The program provided tester notes and testimonial evidence to support the manual execution of interoperability (e.g. interface) tests, as called for by program policy and guidance. However, these tester notes and testimonial do not meet leading practices for planning or documenting results that demonstrate the ability of USCIS ELIS to interface with other systems internal and external to USCIS.

Until the program fully addresses the key practices for systems integration and testing by ensuring the consistent implementation of policy, procedures, and guidance consistent with leading practices, the program risks poor system performance after it has been released to the public. This risk is of particular concern due to system performance issues that have already been realized. Specifically, the program has reported experiencing issues with USCIS ELIS as a result of deploying software that had not been fully tested. For example:

- In June 2015, the Quality Assurance Team reported that production issues, such as bugs and defects, had increased noticeably after the February 2015 deployment.
- In July 2015, the Quality Assurance Team reported that defects (originating from either production or development) were becoming a significant part of USCIS ELIS iteration work.
- On September 22, 2015, in addition to prior and subsequent outages of the system, the Quality Assurance Team reported that USCIS ELIS was unavailable for approximately 15 hours due to issues with code quality.

- 
- On September 24, 2015, USCIS ELIS encountered issues that impacted nearly 5,000 cases. Approximately 2,600 of these cases had to be abandoned.
  - In November and December 2015, the Quality Assurance Team reported that code quality had become a major issue.
  - In January 2016, the program reported more than 800 minutes in unplanned network outages.
  - In February 2016, the program reported missing the threshold for USCIS ELIS reliability (e.g. mean time between failure), for two straight months and four of the last six months.
  - In March 2016, program metrics indicated that production tickets were increasing faster than they could be addressed.

---

## Contract Management Policies Are Not Being Implemented Consistently

Key internal controls, as defined in agency policy and guidance<sup>36</sup> as well as other federal guidance,<sup>37</sup> should be in place to manage oversight of contractors and provide reasonable assurance that performance aligns with expectations. Key internal controls include assigning CORs who have met agency training requirements, documenting the rationale if a performance-based contract is not awarded, defining and assessing contractors against appropriate performance measures if a performance-based contract is awarded, and conducting ongoing monitoring activities.

---

<sup>36</sup>Department of Homeland Security, *Department of Homeland Security Acquisition Regulation* (June 2006); *Department of Homeland Security Acquisition Manual* (October 2009); *Federal Acquisition Certification for Contracting Officer's Representatives and Appointment and Revocation, Acquisition Workforce Policy Number 064-04-003, Revision 02* (Aug. 8, 2012); DHS, *Contracting Officer's Representative (COR) Essential Element Guidebook, Spiral 1* (September 2012); *Office of Procurement Operations: Acquisition Manual, version 1.0* (May 1, 2015).

<sup>37</sup>GAO, *Standards for Internal Control in the Federal Government*, [GAO/AIMD-00-21.3.1](#) (Washington, D.C.: November 1999); Office of Federal Procurement Policy, *A Guide to Best Practices for Contract Administration* (Washington, D.C.: October 1994).

---

We reviewed management and oversight of six contracts supporting the Transformation Program. Two of these were firm-fixed-price<sup>38</sup> task orders<sup>39</sup> and managed by OTC—Program Management Support Services and Training and Instructional Design Services—and the other four were cost plus fixed fee<sup>40</sup> task orders managed by OIT.<sup>41</sup> These four OIT-managed task orders were placed against a single contract for Flexible Agile Development Services (FADS) and share a common performance work statement, tasks, and deliverables.<sup>42</sup> Similarly, one individual within OIT assumed COR responsibilities for all four task orders. We determined that the COR managed each of the four task orders consistently, regardless of contractor.

USCIS had mixed success in implementing selected key internal controls on the contracts we reviewed. For example, while CORs are meeting training requirements, the program can improve monitoring of contracts to

---

<sup>38</sup>A firm-fixed-price contract provides for a price that is not subject to any adjustment on the basis of the contractor's cost experience in performing the contract. This contract type places maximum risk and full responsibility for all costs and resulting profit or loss on the contractor. A firm-fixed-price contract is suitable for acquiring commercial items or for acquiring other supplies or services on the basis of reasonably definite functional or detailed specifications when the contracting officer can establish fair and reasonable prices at the outset. 48 C.F.R. 16.202.

<sup>39</sup>A task order is an order for services placed against an established contract or with government sources. 48 C.F.R. 2.101(b).

<sup>40</sup>A cost-plus-fixed-fee contract is a cost reimbursement contract that provides for payment to the contractor of a negotiated fee that is fixed at the inception of the contract. The fixed fee does not vary with actual cost, but may be adjusted as a result of changes in the work to be performed under the contract. This contract type permits contracting for efforts that might otherwise present too great a risk to contractors, but it provides the contractor only a minimum incentive to control costs. A cost-plus-fixed-fee contract is suitable for use when, among other things, the contract is for development and test, and using a cost-plus-incentive-fee contract is not practical. A cost-plus-fixed-fee contract normally should not be used in development of major systems once preliminary exploration, studies, and risk reduction have indicated a high degree of probability that the development is achievable and the government has established reasonably firm performance objectives and schedules. 48 C.F.R. 16.306.

<sup>41</sup>The Program Management Support Services and Training and Instructional Design Services task orders represent approximately 90 percent of the total funding managed by OTC, as defined in the acquisition plan.

<sup>42</sup>The four Flexible Agile Development Services task orders represent approximately 77 percent of the total funding managed by OIT, as defined in the acquisition plan.



---

CORs are meeting training requirements

provide reasonable assurance that they are meeting program needs. In addition, the program can improve its management and monitoring of performance-based contracts.

Initial and ongoing training requirements for USCIS CORs are clearly detailed in DHS guidance.<sup>43</sup> Because of the size and complexity of the contracts, the CORs were required to maintain the highest level of certification called for in DHS guidance.<sup>44</sup> Specifically, requirements include 60 hours of training when assuming basic COR responsibilities and 40 hours of refresher training every two years after the initial training in order to maintain certification. They must also take specific COR ethics training initially as well as subsequent annual ethics training. In addition, federal regulations and DHS procedures and guidance require CORs to file a financial disclosure form.

Each of the CORs assessed had completed training requirements at the time of appointment and had also documented their completed refresher training requirements for the contracts we reviewed. In addition, the CORs had fulfilled their ethics and financial disclosure requirements.

USCIS documented rationale for not pursuing selected contracts as performance-based

The Federal Acquisition Regulation and OMB guidance direct federal agencies to use a performance-based contract—that is, a contract with measurable performance standards and a method for assessing a contractor’s performance against those performance standards—to the maximum extent practicable when acquiring services.<sup>45</sup> DHS policy<sup>46</sup> also

---

<sup>43</sup>Department of Homeland Security, *Acquisition Workforce Policy Number 064-04-003, Revision 02 and Contracting Officer’s Representative (COR) Essential Elements Guidebook, Spiral 1*.

<sup>44</sup>Because of the complexity of the DHS contract portfolio, CORs can only be certified as level II or level III when training is completed and experience is gained. Level II CORs can manage contracts other than high risk or major investment contracts. Only level III CORs can manage high risk or major investment contracts.

<sup>45</sup>OMB, Office of Federal Procurement Policy, Memorandum for Chief Acquisition Officers and Senior Procurement Executives; Subject: *Use of Performance-Based Acquisitions* (Washington, D.C.: July 21, 2006). The *Federal Acquisition Regulation* refers to performance-based contracting as a contract method; for ease of reporting and for purposes of this review, we include performance-based contracts in our discussion of contract types.

<sup>46</sup>DHS, *Office of Procurement Operations, Acquisition Manual Version 1.0*.

---

encourages the use of performance-based acquisition to the maximum extent practicable. However, if the contract is not performance-based, the acquisition plan must include the rationale.<sup>47</sup>

The two contracts managed by OTC are not performance-based, but the rationale for this decision is documented in the contract file. Specifically, the acquisition plan for program management support services states that it is not performance-based because staffing resources were not sufficient to support this type of acquisition. In addition, it states that tasks listed in the statement of work cannot be converted to a performance-based task. The contract for training and instructional design services included a memo to the contract file that explained the rationale. According to this memo, the contract was a new requirement focused heavily on course development and training on an ongoing basis. As such, there were no established measurable performance standards to draw on. The memo notes that a performance-based acquisition was considered but a performance work statement was ultimately deemed inappropriate. We did not evaluate the rationales provided by the program.

Agile development services contract is performance-based, but expectations are not defined

According to federal government internal control standards, appropriate and relevant performance measures and indicators must be established and continually compared against program goals and objectives.<sup>48</sup> The standards also recommend incorporating performance data into operating reports that inform management of inaccuracies or internal control problems.

The Agile development services contract contains appropriate performance criteria that are linked to the program goals. Specifically, the primary goal of this contract is developing deployable application code that supports the USCIS mission to move towards an innovative, electronic, customer-centric architecture. To achieve this goal, the contractors provide services such as software development using Agile methodologies and testing and integrating code. The performance criteria used to measure contractor performance address code quality and standards adherence; business satisfaction; test quality and test coverage; collaboration; productivity; innovation; and process and

---

<sup>47</sup> *Federal Acquisition Regulation*, 48 C.F.R. 7.105.

<sup>48</sup> [GAO/AIMD-00-21.3.1](#).

---

continuous improvement. The contract also requires the contractors to submit monthly performance and expenditure reports, status briefings, and other program management documentation on a timely basis. According to the Contracting Officer, a contractor that does not meet a performance requirement might have its annual target fee reduced and might not be contracted to provide additional Agile development teams.<sup>49</sup>

USCIS tracks performance data for these contracts through monthly operating reports, referred to as a “performance scorecard.” The scorecards track the accomplishments of most of the performance areas established in the contract. For example, the scorecard assesses the quality of code developed by the contractor and discipline in contractor adherence to program defined processes. The monthly scorecards are prepared by the product manager, project manager, and release manager in OTC and then submitted to the COR, who resides in OIT. Performance is assessed using program records of activities and interactions from the reporting month, metrics provided by the Quality Assurance Team, as well as from self-evaluations submitted by the contractor. The COR does not submit any financial or other status reports to the Contracting Officer regarding ongoing contractor performance, financial and budgetary data, the status of the contract’s schedule, or risk issues. As such, the Contracting Officer relies on the COR, along with separate monthly performance summaries submitted by the contractor, to verbally advise them on any issues.

Although performance criteria were defined in the contracts, the program did not clearly define measures against which to analyze differences between services expected and those delivered. Guidance for completing the performance scorecard identifies possible measures to use in evaluation. For example, this guidance states that contractor code quality should be evaluated, in part, based on the length of time to fix a broken build, the number of code check-ins, number and severity of defects found, and automated test code coverage. However, the measures do not clearly define program expectations, such as the length of time to fix a broken build. Further, contractors were not consistently evaluated against

---

<sup>49</sup>The Agile development services contracts are structured to allow the program to add additional development teams during the period of performance as needed. Each development team can only provide up to a specified level-of-effort and collectively the development teams cannot exceed the cost of the contract.

---

the proposed measures in the guidance. For example, in July 2015, performance measures associated with defects, broken builds, and automated test coverage were not included in evaluating the code quality for three contractors.

In addition, performance scorecards do not measure contractor performance against all of the criteria specified in the contracts. The contracts articulate seven performance measures, while the performance scorecard evaluates contractors against only five performance criteria. Specifically, the scorecard does not evaluate the contractor based on test quality and coverage, or productivity. Further, while the scorecard does assess code quality, it does not fully assess against the associated performance criteria, as it does not assess adherence to coding standards. In an interview, neither the Contracting Officer nor the COR provided a rationale for discrepancies in performance measurement between the contract and the scorecard, although the Deputy Chief of the USCIS Contracting Office stated that the government can change the methodology it uses to measure performance. However, the contract files included no evidence that a change in performance measures was discussed or the reason for omitting certain performance measures specified in the contract.

Some of the performance measures omitted in the performance scorecard are measures that would help provide indicators associated with concerns raised by the Quality Assurance Team in that team's monthly status reports on program performance. For example, in August 2015, the Quality Assurance Team identified testing as a major concern, as it reported that testing before the end of a sprint was inadequate. The Quality Assurance Team reiterated in October 2015 the concern that development teams were not completing basic testing. If test quality and test coverage were considered in these monthly assessments, contractors could be further held accountable for the quality and coverage of tests.

Because oversight of contractor performance resides with OTC and management of the contract is the responsibility of OIT, the need for clearly-defined performance measures is particularly important. Until the program clearly defines appropriate performance measures and indicators for Agile development service contracts, and continually compares contractor performance with expected or planned goals, the agency lacks important information for measuring contractor performance and determining if OIT is meeting its objectives in supporting the program.

---

Monitoring of selected program contracts needs improvement

According to leading practices,<sup>50</sup> ongoing monitoring activities include maintaining a complete contract file, creating a quality assurance surveillance plan, and completing and submitting a contractor performance assessment. The program has at least partially addressed some of these activities, but has not addressed other activities. Specifically, the program uses contractor performance assessments to assess and report performance, and maintains some, but not all, required documentation in its contract files. However, the program is not creating quality assurance surveillance plans to monitor contract performance.

**Program maintained some documentation in COR files**

Contract monitoring leading practices recommend that agencies conduct ongoing monitoring by maintaining contract files. In addition, the DHS COR guidebook states that complete and orderly COR files are vital in administering a contract to ensure that the government and the contractor meet their obligations. When disagreements or questions of interpretation arise, the COR file plays a critical role in resolving a dispute. A proper, well-documented file will also facilitate the transfer of responsibility if the COR is replaced during the contract. The COR must ensure that this file includes records documenting all correspondence, such as e-mails, telephone calls, or formal and informal meetings, between and among the COR, the contractor, the Contracting Officer, and other personnel relating to contractor performance. The file should also include a log of any actions taken as a result of communications with the contractor and other relevant documents, as appropriate, such as the COR appointment letter, approved and accepted deliverables, and copies of all inspection and acceptance documents and invoices.

CORs maintained proper documentation for some contract actions such as contractor onboarding, certifications and associated appointment responsibilities, materials such as market research or resumes of contractor personnel, and had fully documented modifications made to

---

<sup>50</sup>GAO, [GAO/AIMD-00-21.3.1](#); *National Flood Insurance Program: Progress Made on Contract Management but Monitoring and Reporting Could be Improved*, [GAO-14-160](#) (Washington, D.C.: Jan. 15, 2014); Office of Federal Procurement Policy, *A Guide to Best Practices for Contract Administration*; Department of Homeland Security, *Acquisition Workforce Policy Number 064-04-003, Revision 02*; *Contracting Officer's Representative (COR) Essential Elements Guidebook, Spiral 1*; Office of Procurement Operations, *Acquisition Manual Version 1.0*.

---

the contracts. For example, the program management support contract included nineteen modifications that included changes such as the assignment of a new contracting officer, the revision of the statement of work, and extension of the terms of the contract.

However, COR files were not complete. Specifically, the file for the program management support services contract did not document correspondence, meetings, or other communication; excluded a deliverable required in the contract; and inspection and acceptance documents were omitted. The training and instructional design contract excluded correspondence, meetings, or other communication, and all inspection and acceptance documents were omitted. The FADS contract files included correspondence, but excluded other communication, such as monthly performance scorecard review meetings, all inspection and acceptance documents, and some deliverables. For example, contractors submitted a quality management plan, but the plan was not always updated, as specified in guidance. In addition, the file did not include updated plans for each contractor.

Contracting officers stated that they did not review the COR files during performance of the contracts. As a result, contracting officers for the contracts we reviewed relied on the COR to maintain a file and to communicate with the Contracting Officer when the COR deemed it necessary. For example, if there was a discrepancy over performance or the quality of a deliverable, the matter might be escalated to the Contracting Officer. The COR for the program management support and training contracts stated that they assumed various communications should only be documented when a discrepancy arose. Since no discrepancy reports were necessary, the COR believed that correspondence or other communication did not need to be documented. In addition, this official stated that inspection procedures and the acceptability or unacceptability of deliverables were not documented because all parties involved in these processes were aware of the process. The COR for the FADS contracts added that updated quality management plans should have been provided and that this was an oversight.

USCIS provided a policy update that is intended to increase contracting officer oversight of the COR. According to a Contracting Officer, there are new directives regarding the expectations on how the contracting officer reviews COR performance. This official explained that, previously, policy stated that the contracting officer could provide evaluative information on the COR during a performance review. This individual stated that, now,

---

the contracting officer is required to provide mid- and end-of-the-year feedback to the COR supervisor regarding performance. The contracting officer stated that additional improvements in the area are likely going forward.

Although the CORs may be well informed regarding contractor performance and the procedures for inspection and acceptance, a fully documented file should be maintained. Until representatives responsible for day-to-day monitoring of Transformation Program contracts fully document the contract file, the program increases the risk of misunderstandings when disagreements or questions of interpretation arise. Moreover, without a fully documented file, the program may also be unable to effectively transfer responsibility if the COR is replaced during the contract.

### **Quality assurance surveillance plans were not developed**

As discussed earlier, a leading practice in contract monitoring is the development of a quality assurance surveillance plan for performance-based contracts. According to the DHS COR guidebook, the plan should be prepared in conjunction with the performance work statement and should include, among other things, the performance standards, the methods of assessment, an assessment schedule, and a description of corrective actions to be taken if the required performance standards are not met. Development of a plan is important, as it provides a systematic, structured method for the evaluation of services and products that contractors are required to furnish. The quality assurance surveillance plan should focus on the quality delivered by the contractor, not on the steps taken or procedures used.

Contractors developed quality management plans, but these plans did not meet the requirements of a quality surveillance plan as articulated in DHS guidance.<sup>51</sup> The COR and Contracting Officer for the FADS contract stated that they rely on quality management plans and performance scorecard guidance to guide contract surveillance activities. Quality management plans submitted by three of the four FADS contractors

---

<sup>51</sup>The program management support services and training and instructional design services contracts are not performance-based. As such, we did not expect a quality assurance surveillance plan.

---

discuss proposed or planned metrics by which to evaluate each performance requirement, along with potential methods for self-inspection. Moreover, guidance for completing the monthly performance scorecard discusses observable behavior, possible metrics, and additional questions for OTC staff to consider. However, these documents do not reflect committed metrics against which to measure contractor performance; instead, they reflect potential metrics. Moreover, documentation does not define the methods of assessment the COR will undertake, how often an assessment will be performed, or actions the COR will take if performance is not met.

The FADS Contracting Officer acknowledged the need to develop a quality assurance surveillance plan for performance-based contracts, and did not know why one had never been developed. The Contracting Officer explained that, originally, USCIS intended to develop a quality assurance surveillance plan for the FADS contract. However, no one followed through on this action and, since then, the Contracting Officer has changed. The current Contracting Officer stated that various actions are under consideration that may help ensure that quality is more closely monitored for future FADS contracts. For example, the Contracting Officer is actively involved in a re-compete of the original FADS contract, which will expire in late 2016, and expects to include a quality assurance surveillance plan as part of the new contract. The Deputy Chief of the USCIS Contracting Office provided a draft quality assurance surveillance plan for OIT's Agile development contract in May 2016, but did not provide a date for when the document will be finalized.

Until USCIS incorporates the quality assurance surveillance plan to measure contractor performance for FADS, the USCIS Transformation Program risks deploying software code that does not meet the quality standards for development or testing intended for the contract and unplanned expenditures in the future to repair the software.

### **Program used contractor performance assessments**

DHS uses the Contractor Performance Assessment Reporting System to assess and report performance on previous contracts, and applicable regulations and contract management guidance require entry of contract performance assessments in the system. According to DHS's COR guidebook, the COR should prepare an assessment of contractor performance at least annually.



---

USCIS documented performance assessments for all six contracts we reviewed. For example, the program management support services contract we reviewed was active in fiscal years 2011 through 2015. The COR submitted the performance assessments as required during this time. Contractor performance assessments reflected positive evaluations in the areas of quality, schedule, and management, which is consistent with the COR and Contracting Officer statements.

USCIS also documented a performance assessment for the training and instructional design contract. The contract was awarded in April 2014 and active in fiscal years 2014 and 2015. The COR submitted one performance assessment covering contractor performance from July 2014 through July 2015. As with the program management support contract, monitored by the same COR as the training contract, the contractor performance assessment reflected positive evaluations in the areas of quality, schedule, and management, which is consistent with the testimony of the COR and Contracting Officer responsible for management of this contract.

Moreover, USCIS also documented performance assessments for its FADS contracts. The contracts we reviewed were awarded in September 2014 and active in fiscal year 2015. The COR reported performance assessments for all four contractors in March 2016. The FADS contracts operate under a 6-month period of performance, rather than full-year option periods, and therefore performance assessments were not completed prior to exercising the next option. The Contracting Officer explained that the requirement in USCIS is for contractor performance to be assessed annually and, as such, this condition was not changed to accommodate the reduction in period of performance. To mitigate this fact, the Contracting Officer stated that they used the monthly performance scorecard in considering whether to exercise the next option for each contractor.

Although performance assessments were submitted for FADS contractors on time, these assessments did not always align with testimony of the COR and Contracting Officer or documentation in the contract file. For example, two of the FADS contractors were rated as being unsatisfactory in the area of cost control, leading one of the contractors to not concur with the assessment and request a re-evaluation. In prior interviews, the COR responsible for monitoring the FADS contracts stated that contractor performance was satisfactory and that no discrepancy reports had been filed. Since then, the Contracting Officer provided correspondence that was not included as part of the COR file, which indicated that USCIS

---

communicated with both contractors regarding a deviation from the agreed level-of-effort for the contract.

Until USCIS takes steps to improve the consistency with which contractors are evaluated in the Contractor Performance Assessment Reporting System and documents those steps, it and the Transformation Program will risk disputes in the annual assessment of contractor performance.

---

## Program's Life Cycle Cost Estimate Was Reliable

GAO's *Cost Estimating and Assessment Guide*<sup>52</sup> identifies a number of best practices that are the basis of effective program cost estimating and should result in reliable and valid cost estimates that management can use for making informed decisions. Specifically, a reliable cost estimate should be comprehensive (costs are neither omitted nor double counted); well-documented (the estimate is thoroughly documented, including source data and significance, clearly detailed calculations and results, and explanations for choosing a particular method or reference); accurate (the estimate is unbiased, not overly conservative or overly optimistic, and based on an assessment of most likely costs); and credible (the estimate discusses any limitations of the analysis from uncertainty or biases surrounding data or assumptions).

In February 2015, OTC updated the life cycle cost estimate for the Transformation Program, with an expected cost of no more than \$3.1 billion. DHS subsequently approved the revised estimate in April 2015 as part of the program re-baseline. Changes in the cost estimate accounted for, among other things, new contracts and a revised schedule to support the Agile software development strategy. Such changes represented an additional \$275 million in acquisition cost.

We determined that OTC's February 2015 cost estimate met the characteristics of a reliable estimate. Specifically:

- The program life cycle cost estimate was well documented. For example, USCIS officials demonstrated the estimate source data, the calculations performed, and estimating methodology used to derive

---

<sup>52</sup>[GAO-09-3SP](#).

---

costs, and step-by-step tracing of the basis of estimate for each cost element. Further, the documentation reflected the information in the technical baseline description and the program demonstrated that the cost estimate had been reviewed and accepted by management, including a recent briefing to management in March 2015 that clearly explained the cost estimate.

- The program estimate was substantially comprehensive. For example, the estimate tracked well to the technical scope defined in the cost estimating baseline document, had a work breakdown structure that was product-oriented and at an appropriate level of detail, and appeared to document major ground rules and assumptions. The estimate also included all life cycle costs, with the rationale of the program extending through 2033, assuming 15 years of operations after achieving full operational capacity. However, there were no costs for retirement or decommissioning documented in the life cycle cost estimate. Nevertheless, we found the estimate to be sufficiently comprehensive.
- The program estimate was substantially accurate. Specifically, the estimate was based on comparable historic programs, contained few or minor mistakes, and the main estimating technique of extrapolating costs from actual contractual data was used to estimate almost all of the remaining costs. Inflation was also applied correctly and was embedded within the cost model. Transformation officials consistently review USCIS planned versus actual costs, as the life cycle cost estimate is required to be updated annually by DHS. As part of this update, actual costs for prior and current years are documented in the program's cost model and then reviewed and approved by management for the next life cycle cost estimate revision.

However, variances between planned and actual costs were not always tracked. In addition, the cost estimate is funded to the 80 percent confidence level, which is conservative. Nevertheless, we found the estimate to be sufficiently accurate at the time it was developed.

- The program estimate was substantially credible. For example, USCIS conducted sensitivity analysis to test the impacts of changes to program cost drivers. In addition, the estimating team performed a cost risk uncertainty analysis on associated elements of the cost model to determine the probability that a specific cost target would be exceeded. The results of this analysis showed that the initial cost estimate was at the 22 percent confidence level. However, the program added contingency funding to increase the level of confidence to the 80th percentile. This high level of confidence

---

assumes most program risks will occur and cannot be successfully mitigated, which is conservative. In addition, program officials reported that the current version of the life cycle cost estimate does not include any crosschecks, as this was done for an earlier estimate and the results were still considered valid. Finally, while DHS reviewed the USCIS life cycle cost estimate and found it to be reasonable, no independent cost estimate was developed to check whether other estimating methods produced similar results. Nevertheless, we found the estimate to be sufficiently credible.

---

## Conclusions

Prior to the change in acquisition strategy, USCIS spent more than 8 years and more than \$475 million in developing a system that proved to be unstable and decommissioned it in April 2016. This previous system proceeded through development despite limited oversight and challenges in program management. Given this history and the subsequent commitment of additional resources for a new system, it is more important than ever that USCIS consistently follow leading practices and agency policy and guidance in its system development efforts. Consistent implementation can provide reasonable assurance that the program will deliver a quality system that meets user needs in a timely and cost-effective manner.

The USCIS Transformation Program has at least partially addressed many of the practices we identified for implementing Agile software development, adhering to leading practices and agency guidance in systems integration and testing, and monitoring the largest Transformation program contractors. Moreover, it developed a reliable estimate against which to monitor program cost performance on an annual basis. Partial adherence to the relevant practices shows the program has taken some important steps to help ensure effective development of its new system. The program has also shown improvement in addressing specific practices over time during the course of this review.

Nevertheless, the program is still inconsistently following leading practices and agency policies and guidance in Agile software development, systems integration and testing, and contract management. By not fully implementing documented policies and guidance, some of which are limited and do not address important leading practices, the program is once again increasing the likelihood that obstacles similar to those encountered with the original deployment of USCIS ELIS will be encountered again. In addition, the program runs the risks that

---

deployment of the system will continue to face delays, that the functionality deployed will be of limited quality, and that production issues will delay performance of the system and the processing of filings for citizenship and immigration benefits.

The USCIS Transformation Program is in a relatively early stage of development. However, as additional major releases are deployed, the complexity of the effort will increase, as will the risks associated with not having addressed management deficiencies. By implementing software development consistent with its policy and guidance, and following leading practices, along with introducing additional internal controls, USCIS will increase the likelihood that the Transformation Program will ultimately meet the expectations and needs of USCIS, DHS, and the people that the program intends to serve.

---

## Recommendations for Executive Action

We are making 12 recommendations aimed at improving information technology program management:

To provide reasonable assurance that the program executes Agile software development for USCIS ELIS consistent with its own policies and guidance and follows applicable leading practices, we recommend that the Secretary of DHS direct the Director of USCIS to direct the USCIS CIO, in coordination with the DHS CIO and the Chief of OTC, to review and update, as needed, existing policies and guidance and consider additional controls to:

- Complete planning for software releases prior to initiating development and ensure software meets business expectations prior to deployment.
- Consistently implement the principles of the framework adopted for Agile software development.
- Define and consistently execute appropriate roles and responsibilities for individuals responsible for development activities consistent with its selected development framework.
- Identify all system users and involve them in release planning activities.
- Write user stories that identify user roles, include estimates of complexity, take no longer than one sprint to complete, and describe business value.
- Establish outcomes for Agile software development.

- 
- Monitor program performance and report to appropriate entities through the collection of reliable metrics.

To help manage the USCIS ELIS system, we recommend that the Secretary of DHS direct the Director of USCIS to direct the USCIS CIO, in coordination with the DHS CIO and the Chief of OTC, to review and update existing policies and guidance and consider additional controls to

- Conduct unit and integration, and functional acceptance tests, and code inspection consistent with stated program goals.
- Develop complete test plans and cases for interoperability and end user testing, as defined in the USCIS *Transformation Program Test and Evaluation Master Plan*, and document the results.

To help improve oversight of selected Transformation Program contracts, we recommend that the Secretary of DHS direct the Director of USCIS to direct the Chief of the USCIS Contracting Office, in coordination with the appropriate contracting officer, to consider inconsistencies between policy and leading practices in contract administration and, as needed, institute controls to

- Clearly define measures against which to analyze differences between services expected and those delivered.
- Ensure CORs are maintaining complete contract files.
- Ensure quality assurance surveillance plans are developed when appropriate.

---

## Agency Comments and Our Evaluation

We received written comments on a draft of this report from DHS. The comments are reprinted in appendix V.

In the comments, DHS concurred with our recommendations and also described ongoing and planned actions to address 11 of them, including milestones for completion. The planned steps the department described will likely be sufficient to address these 11 recommendations if they are effectively implemented. For example, for the recommendation aimed at monitoring and reporting on program performance, DHS stated that it is updating guidance for collecting Transformation Program metrics and expanding the number of metrics to include a better representation of actions. DHS intends to complete this update, along with others aimed at improving Agile software development, by January 2017. In addition, for two recommendations aimed at improving contract management, the department stated that the USCIS Office of Contracting will conduct a

---

variety of training to increase awareness and conduct an internal audit to further ensure compliance. The department stated that it plans to complete actions associated with all eleven of our recommendations by July 2017.

Regarding our remaining recommendation that DHS write user stories that identify user roles, include estimates of complexity, take no longer than one sprint to complete, and describe business value, the department requested that GAO consider the recommendation resolved and closed, as implemented. The department stated that USCIS OIT and OTC currently follow a user story process that was implemented in April 2013 where both written and oral communication ensures that the information necessary to understand user roles and business value is shared. Nevertheless, as noted in our report, we found that the process implemented in April 2013 resulted in user stories taking longer than one sprint to complete and that user stories did not adequately describe business value. As such, we do not believe that the recommendation can be closed as implemented until the program takes steps to improve its practices in this area. DHS also provided technical comments which we have incorporated as appropriate.

---

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 8 days from the report date. At that time, we will send copies to the appropriate congressional committees, the Secretary of Homeland Security, and other interested parties. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-4456 or [chac@gao.gov](mailto:chac@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix VI.



Carol C. Harris  
Director  
Information Technology Acquisition Management Issues

---

*List of Requesters*

The Honorable Ron Johnson  
Chairman  
Committee on Homeland Security and Government Affairs  
United States Senate

The Honorable Michael T. McCaul  
Chairman  
The Honorable Bennie G. Thompson  
Ranking Member  
Committee on Homeland Security  
House of Representatives

The Honorable Scott Perry  
Chairman  
The Honorable Bonnie Watson Coleman  
Ranking Member  
Subcommittee on Oversight and Management Efficiency  
Committee on Homeland Security  
House of Representatives

The Honorable Candice S. Miller  
House of Representatives

The Honorable Jeff Duncan  
House of Representatives



---

# Appendix I: Objectives, Scope, and Methodology

---

Our objective was to assess the extent to which the U.S. Citizenship and Immigration (USCIS) Transformation Program is using information technology (IT) program management leading practices. To do so, we assessed the extent to which USCIS is implementing Agile software development for USCIS ELIS; adhering to leading practices and agency guidance<sup>1</sup> in system integration and testing; following leading practices in monitoring the largest Transformation Program contractors; and developing a life cycle cost estimate for the Transformation Program consistent with our cost estimating guidance.

To assess the extent to which the program is implementing Agile software development for USCIS ELIS, we identified Agile software development leading practices and guidance outlined in the following sources:

- *Software Development: Effective Practices and Federal Challenges in Applying Agile Methods*<sup>2</sup>
- *U.S. Digital Services Playbook*<sup>3</sup>
- *TechFAR handbook*<sup>4</sup>
- Department of Homeland Security (DHS), *Agile Management Instruction*<sup>5</sup>
- DHS, *Agile Development Guidebook*<sup>6</sup>

---

<sup>1</sup>For the purposes of this report, guidance refers to a variety of USCIS and program-level documentation, such as plans, guidelines, and team artifacts.

<sup>2</sup>GAO, *Software Development: Effective Practices and Federal Challenges in Applying Agile Methods*, [GAO-12-681](#) (Washington, D.C.: Jul. 27, 2012).

<sup>3</sup>Office of Management and Budget, U.S. Digital Services, *Playbook* (version pulled Dec. 18, 2015).

<sup>4</sup>Office of Management and Budget, *TechFAR: Handbook for Procuring Digital Services Using Agile Processes* (draft version pulled Nov. 6, 2014).

<sup>5</sup>Department of Homeland Security, *Instruction Number: 102-01-004, Agile Development and Delivery for Information Technology, Revision #0*, (Apr. 11, 2016).

<sup>6</sup>Department of Homeland Security, *Draft, DHS Agile Development Guidebook* (Sept. 2, 2014).

- DHS, *Agile White Paper*<sup>7</sup>
- USCIS, *Agile Development Policy*<sup>8</sup>
- USCIS, *Agile Processes and Practices Principles and Guidelines, version 4.0*<sup>9</sup>
- USCIS, *USCIS Transformation Program: System Engineering Life Cycle Tailoring Plan, version 1.0*<sup>10</sup>
- USCIS, *Team Process Agreements*<sup>11</sup>
- *Agile Metrics: Progress Monitoring of Agile Contractors*<sup>12</sup>
- *Principles Behind the Agile Manifesto*<sup>13</sup>
- *The Scrum Guide*<sup>14</sup>
- *Standard 26515 for Agile User Documentation*<sup>15</sup>
- *CMMI for Development, version 1.3*<sup>16</sup>

---

<sup>7</sup>Department of Homeland Security, *Draft, Agile Methodologies in DHS: Agile Working Group White Paper* (no date).

<sup>8</sup>U.S. Citizenship and Immigration Services, *Management Instruction CIS-OIT-001, Office of Information Technology: Agile Development Policy* (Apr. 10, 2013).

<sup>9</sup>U.S. Citizenship and Immigration Services, *Agile Processes and Practices Principles and Guidelines, version 4.0* (Dec. 6, 2013).

<sup>10</sup>U.S. Citizenship and Immigration Services, *USCIS Transformation Program: System Engineering Life Cycle Tailoring Plan, version 1.0* (March 2015).

<sup>11</sup>U.S. Citizenship and Immigration Services, *USCIS Team Process Agreement for ELIS, version 1.1 (Jun. 3, 2014); USCIS Team Process Agreement for ELIS2, updated for releases 5.1, 5.2, and 6.0 (10/15/14 to 04/15/15); USCIS ELIS Team Process Agreement for the April 7, 2015 to September 30, 2015 Development Period; and USCIS ELIS Team Process Agreement for the July 22, 2015 to January 30, 2016 Development Period.*

<sup>12</sup>SEI, *Agile Metrics: Progress Monitoring of Agile Contractors*, CMU/SEI-2013-TN-029 (Jan. 2014).

<sup>13</sup><http://agilemanifesto.org>.

<sup>14</sup>Ken Schwaber and Jeff Sutherland, *The Scrum Guide:™ The Definitive Guide to Scrum: The Rules of the Game* (Jul. 2013).

<sup>15</sup>ISO/IEC/IEEE, *Systems and Software Engineering —Developing User Documentation in an Agile Environment*, corrected version, ISO/IEC/IEEE 26515:2012(E) (Mar. 15, 2012).

<sup>16</sup>SEI, *CMMI® for Development, Version 1.3*, CMU/SEI-2010-TR-033 (Nov. 2010).

- *Defense Acquisition Agile Guide*<sup>17</sup>
- *Handbook for Implementing Agile in DOD IT Acquisition*<sup>18</sup>

After reviewing the sources listed, we grouped key Agile software development processes into eight key areas: software release practices, software development events and principles, software development roles and responsibilities, user involvement in release planning, user story definition and development, user story prioritization, establishing outcomes for Agile software development, and tracking and reporting of program metrics. As part of our assessment of these eight areas, we reviewed relevant plans and documentation and interviewed USCIS staff. We determined whether the information was fully, partially, or not present, and recorded the presence of this information by recording our evaluations as “yes,” “partial,” or “no.” An element was a “no” if the program provided no evidence to satisfy any portion of the practice; “partial” if the program provided evidence that satisfied some, but not all, of the practice; and “yes” if the program provided evidence that it substantially satisfied all elements of the practice.

To obtain a better understanding of the program’s Agile software development approach, we performed on-site observations over a 3-week period. During these observations, we attended development team meetings including 2 sprint planning sessions, about 55 daily stand-ups, about 10 cross-team meetings, 1 user story demonstration, and 2 sprint reviews. We did not attend a retrospective because no retrospectives were held during the period we observed. In addition to observing team meetings, we documented program planning artifacts posted on the walls of team common areas and individual team rooms. We compiled our observations and noted potential issues.

To evaluate compliance with software release practices, we first reviewed USCIS Agile software development policy and guidelines to define the requirements for release planning and readiness reviews. We reviewed required documentation associated with planning for major releases of

---

<sup>17</sup>MITRE, *Defense Agile Acquisition Guide: Tailoring DOD IT Acquisition Program Structures and Processes to Rapidly Deliver Capabilities* (Mar. 2014).

<sup>18</sup>MITRE, *Handbook for Implementing Agile in Department of Defense Information Technology Acquisition* (Dec. 15, 2010).

USCIS ELIS, which were releases 5.0, 5.1, 6.1, 6.2, and 7.1. This included reviewing, among other documentation, capabilities and constraints, team process agreements and project oversight plans. We also reviewed approval memos associated with each release to determine the date when approval was granted and to analyze the level of review performed prior to approval. We then compared the approval date in the memo to the first date in which development occurred for a release to determine if development occurred prior to approval. We also reviewed all required documentation associated with deployment (i.e. readiness) of all major releases of USCIS ELIS as of March 2016. These releases were releases 5.0, 5.1, and 6.1. This included a review of, among other documentation, automated test scripts and security reports. As with release planning, we also reviewed approval memos associated with deployment of each major release to analyze the level of review performed prior to approval.

To evaluate adherence to software development events and principles described in the selected framework, we reviewed team process agreements governing development of USCIS ELIS, Quality Assurance Team assessments of development team adherence to USCIS Agile software development policy and contract documentation for the development of USCIS ELIS to determine the framework within which development teams were operating. Based on this framework, we reviewed related artifacts, such as

- capabilities and constraints documents reflecting sub-features commitments made for each release;
- team process agreements; and
- consolidated release assessments prepared by the Quality Assurance Team.

This documentation allowed us to track development teams and the program through the development of each major software release of USCIS ELIS. To evaluate the reliability of data contained in the supporting documentation, we submitted questions and interviewed USCIS staff regarding internal controls of the consolidated release assessments completed by quality assurance analysts to monitor various software development events. We determined that data contained in these assessments were sufficiently reliable for our purposes. We then interviewed USCIS staff to reconcile any gaps identified in our findings.

To evaluate software development roles and responsibilities, we reviewed the Office of Transformation Coordination (OTC) management model, which describes the program's approach to managing USCIS ELIS, and associated descriptions provided by OTC, general roles and responsibilities defined for the framework referenced for development of USCIS ELIS (e.g. Scrum), OTC organizational chart, and team rosters for developing and maintaining USCIS ELIS. We also interviewed USCIS staff, including government project managers and product owners, and contractor development team technical leads to further understand roles and responsibilities. To validate testimony, we compared statements against program documentation, such as contractor performance work statements, quality management plans, consolidated release assessments, and team process agreements.

To evaluate user involvement in release planning, we first reviewed artifacts provided by the Business Integration Division within OTC, including process scenarios, participation lists, and meeting minutes. We confirmed participation lists with representatives from the USCIS Service Center Operations and Field Operations directorates. We then reviewed memoranda of agreement governing the assignment of subject matter experts from other USCIS directorates or program offices in support of the program. We interviewed USCIS staff to determine the relative involvement of groups in the development of user stories during release planning.

To evaluate user story definition and development and user story prioritization, we reviewed versions of the backlogs for releases 5.0, 5.1, 6.1, 6.2, and 7.1 provided to us between November 2014 as part of a prior audit<sup>19</sup> and March 2016. To evaluate the reliability of data contained in the backlogs, we submitted questions and interviewed USCIS staff regarding internal controls of the Agile life cycle management software tools used by the program at various stages of development. We determined that user story data contained in the backlogs were sufficiently reliable for our purposes. We further interviewed product owners responsible for overseeing development of USCIS ELIS and maintenance of the release backlogs, along with other staff facilitating

---

<sup>19</sup>GAO, *Immigration Benefits System: Better Informed Decision Making Needed on Transformation Program*, [GAO-15-415](#) (Washington, D.C.: May 18, 2015).

product owners, to determine how user stories were ordered and prioritized to maximize the value of each development cycle. We validated product owner statements by comparing those statements against the sequence of development, as reflected in the release backlogs.

To evaluate the identification, tracking, and reporting of program metrics, we interviewed USCIS staff, including the Quality Assurance Team, who are responsible for the collection of program metrics, to understand the metrics collected by the program and the purpose for each metric. Based on these responses, we analyzed documentation provided by the program to show evidence of data collection and application, including but not limited to:

- work in progress spreadsheets for user story and incident tracking;
- consolidated release assessments;
- development progress metrics such as cumulative flow diagrams;
- external customer satisfaction surveys; and
- deployment cycle times.

To evaluate the reliability of data contained in the supporting documentation, we submitted questions and interviewed USCIS staff on internal controls for systems or manual collection on which metrics are based. We determined that data used to compile program metrics for reporting and internal monitoring were sufficiently reliable for our purposes. Any concerns with data reliability are raised in the report; however, we determined that these concerns did not impact our findings or conclusions.

To evaluate the program's monitoring and reporting against reliable Agile software development, cost, schedule, and performance outcomes, we first interviewed USCIS staff, submitted written questions, and reviewed USCIS Agile software development policy and guidelines to understand the program's goals specific to Agile software development. We then reviewed the *USCIS Transformation Program Acquisition Program Baseline* (program level) and *USCIS Office of Transformation Coordination Lifecycle Cost Estimate*, which define the approved cost and schedule goals for the program. We compared these goals against progress reflected in program reports to management, such as program management reviews and Executive Steering Committee presentations, and the integrated master schedule maintained by the program to

determine the extent to which the program was meeting cost and schedule goals. We also reviewed the backlogs for releases 6.1, 6.2, and 7.1 to determine the reliability and traceability between sub-feature commitments reported to the DHS Office of Program Accountability and Risk Management and user stories developed in those releases. As with our reporting on tracking of other program metrics (i.e. customer satisfaction), any concerns with data reliability are raised in the report; however, these concerns did not impact our findings or conclusions.

To assess the extent to which the program is adhering to leading practices and agency guidance in USCIS ELIS integration and testing, we began by reviewing the following sources to determine areas appropriate to select for this review:

- DHS, *Agile Development Guidebook*<sup>20</sup>
- USCIS, *Test and Evaluation Master Plan*<sup>21</sup>
- USCIS, *Team Process Agreement*<sup>22</sup>
- *USCIS Test Plan for Release 5.1-6.0 (10/15/2014-4/15/2015)*
- *USCIS Test Plan (updated July 2015)*
- USCIS, *Agile Development Policy*<sup>23</sup>
- USCIS, *Agile Processes and Practices Principles and Guidelines, version 4.0*<sup>24</sup>
- *Software Testing Standards*<sup>25</sup>

---

<sup>20</sup>Department of Homeland Security, *Pre-Decisional Draft, DHS Agile Development Guidebook*.

<sup>21</sup>U.S. Citizenship and Immigration Services, *USCIS Test and Evaluation Master Plan: Electronic Immigration System, version 1.0*.

<sup>22</sup>U.S. Citizenship and Immigration Services, *USCIS ELIS Team Process Agreement for the April 7, 2015 to September 30, 2015 Development Period; and USCIS ELIS Team Process Agreement for the July 22, 2015 to January 30, 2016 Development Period*.

<sup>23</sup>CIS-OIT-001.

<sup>24</sup>U.S. Citizenship and Immigration Services, *Agile Processes and Practices Principles and Guidelines, version 4.0*.

The areas we selected for review during this audit reflected USCIS's implementation of continuous integration development and continuous testing practices (such as unit and integration tests), automating of those practices as applicable, delivering business value to the customer (such as functional acceptance and end user tests), and ensuring that the software performs as intended in a larger software ecosystem (interoperability tests).

More specifically, we selected the following areas for review:

- establishing an environment and procedures for continuous integration and testing of code;
- performing continuous testing through the use of unit and integration tests, functional acceptance tests, and code inspection; and
- developing complete test plans and cases for interoperability and end user testing and documenting those results.

The scope of our assessments spanned the development period for USCIS ELIS releases 6.1 and 6.2, which began in April 2015.

After reviewing the documents listed above, we identified processes, tools, and practices necessary to support continuous integration of Agile software development, such as configuration management, frequent code submission, automation of builds and tests, the ability to detect and stop defective code from progressing in the development process, and the ability to provide rapid feedback to developers and stakeholders about the health of the development process. With respect to continuous integration, we evaluated the existence or absence of the practices applied to the USCIS ELIS development process as required by USCIS policy and guidelines. We determined whether a given practice or process was implemented, partially implemented, or not implemented and applied corresponding “yes”, “partial”, or “no” ratings.

To evaluate the environment and procedures established by USCIS for continuous integration and testing of the newly developed or modified code, we reviewed the team process agreement for releases 6.1 and 6.2, test plan, and Quality Assurance Team documentation. This allowed us to

---

<sup>25</sup>IEEE, *IEEE Standard 29119, Software and System Engineering – Software Testing, Part 1: Concepts and Definitions, Part 2: Test Process, Part 3: Test Documentation* (New York, NY: September 2013).



determine what processes and tools are employed in USCIS ELIS production, how newly developed code flows through various quality gates and development stages, and whether the process is automated. Based on document review, we requested script files from the tools used in code development to verify implementation of the continuous integration and testing. We also requested outputs from the automated tools that indicated successful code build as well as unsuccessful outputs to verify the existence of the feedback mechanism. In addition, we observed live demonstrations of the tools used in developing USCIS ELIS and obtained artifacts from those tools, such as build and deployment scripts, logs, and screenshots. We also interviewed technical leads from each of the Flexible Agile Development Support contracts as well as the Senior Technical Lead responsible for the continuous integration and deployment of USCIS ELIS about the implementation of continuous integration and testing practices during the USCIS ELIS development life cycle.

To evaluate continuous testing, we examined the program's efforts to use unit and integration tests, functional acceptance tests, and code inspection. For unit and integration testing, we interviewed agency officials, including team technical leads and the Quality Assurance Team lead. We also reviewed the USCIS *Transformation Program Test and Evaluation Master Plan*, which established code coverage standards for unit and integration tests. In addition, we reviewed team process agreements and the *USCIS ELIS Test Plan*. We requested and reviewed test summary reports and Quality Assurance Team monthly and weekly reports. Based on the document review, we were able to determine whether unit or integration tests were being executed. Based on the review of the Quality Assurance Team reports, we identified deficiencies listed in the reports and, to the extent possible, whether the problem persisted over time. With respect to code coverage, we evaluated documentation of code coverage provided by the program. This documentation was based on data from an automated tool used in developing USCIS ELIS. We determined the data to be reliable for the purpose of our audit.

To evaluate whether USCIS delivered intended functionality for each user story to the user, we evaluated whether functional acceptance tests were executed. We requested artifacts associated with a random sample of 80 user stories drawn from the release 6.1 and 6.2 backlog submitted to us in October 2015. We requested documentation and participated in an on-site evaluation of the results captured in the software development tool. We evaluated whether each of the user stories had associated

acceptance criteria, since those are the basis for the acceptance tests. We also verified whether test results were attached with the user story. Based on the evaluation of the documentation, we determined whether the program met this requirement (“yes”), met the requirement partially (“partial”), or did not meet the requirement (“no”). To fully meet the requirement, we expected the program to provide documentation of acceptance criteria and acceptance tests for all user stories in the sample. A partial rating indicates that some, but not all, of the expected artifacts were captured in the software development tool.

To evaluate code inspection, we began by reviewing leading practices<sup>26</sup> and USCIS policy. Based on the documentation provided and testimonial evidence, we determined that the program uses both automated and manual code inspection in developing USCIS ELIS. In particular, we determined that USCIS had integrated automated code inspection into its continuous integration process and that code is inspected manually by the Quality Assurance Team and by developers during the peer review process. To evaluate the code inspection process, we interviewed technical team leads and Quality Assurance Team staff. We also observed a demonstration of the tools used for automated code inspection and how those tools are used in the software development life cycle. In addition, we reviewed coding standards used by the automated tools to identify code quality issues. With respect to peer review manual inspection, we reviewed logs from the version control software and verified whether the code was peer reviewed prior to being merged with the code used for deployment into production for a random sample of 80 user stories selected from the backlog for releases 6.1 and 6.2.

We also examined the extent to which USCIS has developed complete test plans and cases for interoperability and end user testing and documented those results. To evaluate interoperability and end user testing, we identified leading practices<sup>27</sup> related to test plans, test cases developed and based on the test plan, and test completion reports that are compiled after execution of the test cases. We requested and reviewed interoperability and end user test plans, test cases, and test completion reports. We also interviewed testers from the interoperability

---

<sup>26</sup>IEEE, *IEEE Standard 29119-1*.

<sup>27</sup>IEEE, *IEEE Standard 29119-3*.

test team and live interface test team and agency officials responsible for end user testing. In addition, we submitted questions about end user testing practices and processes to the independent testing team. We then determined whether test documentation provided by the program met industry practices by noting if the documentation addressed all of the leading practices (“yes”), a subset of leading practices (“partial”) or none of the practices (“no”).

To assess the extent to which the USCIS Transformation Program followed leading practices in monitoring the largest Transformation Program contracts, we selected the two largest Transformation Program contracts managed by OTC—the program management and support services contract and the training and instructional design services contract—and the four largest contracts managed by the Office of Information Technology (OIT)—four Flexible Agile Development Services (FADS) contracts. Specifically, using the acquisition plan approved for the Transformation Program in March 2015, we identified all of the active contracts identified in the plan as of July 2015 and the total amount of funds to be obligated to Transformation Program contractors. To narrow the number of contractors selected for review, we selected contracts managed by both OTC and OIT. As shown in table 6, the total contract dollars for the two OTC managed contractors we selected represented approximately 90 percent (\$50 million out of a total of \$56 million) of the overall active contracting dollars planned for OTC contracts. The total contract dollars for the four OIT managed contractors we selected represented approximately 77 percent (\$235 million out of a total of \$307 million) of the overall active contracting dollars planned for OIT contracts.

**Table 6: Dollar Amount for USCIS Contractors for the Transformation Program, as reflected in the USCIS Transformation Program Acquisition Plan as of March 2015**

Contract name	Description	Total value (millions)	Ownership
Front End Visualization Services	Software visualization tool that provides the capability for incorporating visualized requirements into the requirements generation and management process.	\$0.24	OTC
Requirements Development and Support Services	Services to assist and support the requirements management process to create and maintain the requirements/product backlog for USCIS ELIS.	2.60	OTC
Operational Test and Evaluation Services	Operational test and evaluation services	2.80	OTC
Training and Instructional Design Services	Allows creation and implementation of instructor-led and Web-based training.	11.36	OTC

**Appendix I: Objectives, Scope, and Methodology**

<b>Contract name</b>	<b>Description</b>	<b>Total value (millions)</b>	<b>Ownership</b>
Program Management and Support Services	Program management support to OTC.	38.60	OTC
Transformation Integration & Configuration Services	Integrates source code received from different sources, prepares it for integrated testing, and promotes builds between test, stage, and production environments. Activities pertain to USCIS ELIS and some of the systems supporting USCIS ELIS.	11.90	OIT
Certification and Accreditation	Certification and accreditation of the Solution Architect systems.	28.32	OIT
Architecture and Design Services	Services for the definition and governance of architecture and design of all USCIS systems.	31.74	OIT
Flexible Agile Development Services	Sources Agile development teams to support USCIS ELIS development efforts.	52.99	OIT
Flexible Agile Development Services	Same description.	58.58	OIT
Flexible Agile Development Services	Same description.	61.09	OIT
Flexible Agile Development Services	Same description.	62.24	OIT

Source: GAO analysis of USCIS Transformation Program Acquisition Plan | GAO-16-467.

Note: Two additional contracts were current as of the date the Acquisition Plan was approved. These contracts provided continued development services, until the Flexible Agile Development Services contract was awarded, and independent verification and validation services. Both contracts were set to expire in May 2015 and were therefore not considered during our selection of contractors for review.

We compared USCIS' contract management practices to criteria outlined in the following sources:

- *The Federal Acquisition Regulation*
- *Standards for Internal Control in the Federal Government*<sup>28</sup>
- *A Guide to Best Practices for Contract Administration*,<sup>29</sup> and
- DHS, *Contracting Officer's Representative Essential Element Guidebook, Spiral 1*<sup>30</sup>

<sup>28</sup>[GAO/AIMD-00-21.3.1](#).

<sup>29</sup>Office of Federal Procurement Policy, *A Guide to Best Practices for Contract Administration* (Washington, D.C.: October 1994).

<sup>30</sup>Department of Homeland Security, *Contracting Officer's Representative (COR) Essential Element Guidebook, Spiral 1* (September 2012).

- 
- DHS, *Department of Homeland Security Acquisition Regulation*<sup>31</sup>
  - DHS, *Department of Homeland Security Acquisition Manual*<sup>32</sup>
  - DHS, *Acquisition Workforce Policy Number 064-04-003, Revision 02*<sup>33</sup>
  - DHS, *Office of Procurement Operations: Acquisition Manual, version 1.0*<sup>34</sup>

We grouped key contract management processes into four key areas using the sources listed: training and ethics requirements for contracting officer's representative (COR), documentation required for contracts that are not performance-based, definition of performance measures for contracts that are performance-based, and ongoing monitoring and reporting. We then assessed these areas based on six key sub-areas described in the body of this report: COR training and ethics, non-performance based contracting, performance measures, COR file maintenance, quality assurance surveillance plans, and contractor performance assessments. As part of our assessment, we reviewed relevant plans and documentation and interviewed USCIS staff. For each contract, we determined whether the information was fully, partially, not present, or not applicable for each key sub-area. For each contract, we recorded our evaluations as "yes," "partial," "no," or "not applicable." An element was a "no" if USCIS provided no evidence that satisfied any portion of the practice; "partial" if USCIS provided evidence that satisfied some, but not all, of the practice; and "yes" if USCIS provided complete evidence that it fully satisfied the practice. We consolidated our evaluation of the four FADS contracts as the results of our assessment were consistent across each contract.

---

<sup>31</sup>Department of Homeland Security, *Department of Homeland Security Acquisition Regulation* (June 2006).

<sup>32</sup>Department of Homeland Security, *Department of Homeland Security Acquisition Manual* (October 2009).

<sup>33</sup>Department of Homeland Security, *Federal Acquisition Certification for Contracting Officer's Representatives and Appointment and Revocation, Acquisition Workforce Policy Number 064-04-003, Revision 02* (Aug. 8, 2012).

<sup>34</sup>Department of Homeland Security, *Office of Procurement Operations: Acquisition Manual, version 1.0* (May 1, 2015).

To conduct our assessment for each of the selected contracts, we reviewed the statements of work or performance work statements, monthly contractor performance summaries, resource expenditure and monitoring reports, contract deliverables, other COR file documentation, and annual assessments. We collected data and conducted interviews with representatives from USCIS on their contract management roles and responsibilities, including the COR and contracting officer for each contract, and other representatives from the contracting office for further insight on the extent to which the program had followed monitoring policies and procedures.

To examine the extent to which the USCIS cost estimate for the Transformation Program was consistent with leading practices, we relied on the leading practices contained in our cost guide.<sup>35</sup> We evaluated the USCIS *Office of Transformation Coordination Life Cycle Cost Estimate*, version 2.0, dated February 2015, including assumptions and results, to determine whether the cost estimate was comprehensive, well-documented, accurate, and credible. We obtained and reviewed documentation, including the program office estimate, software cost model, and risk and uncertainty analysis. We also met with key program officials, such as USCIS staff and contractors responsible for preparing and maintaining the program cost estimate, to present the preliminary results of our assessment of the program's cost estimate and obtained explanations and clarifications.

To analyze the program cost estimate against the leading practices documented in our cost guide, we reviewed program documentation and conducted interviews with program officials to understand the methodology USCIS had used to create its estimates. We developed an overall assessment rating for each leading practice using the following definitions:

- Not met: USCIS provided no evidence that satisfied any portion of the practice.
- Minimally met: USCIS provided some evidence that satisfied a small portion of the practice.

---

<sup>35</sup>[GAO-09-3SP](#).

- Partially met: USCIS provided evidence that satisfied about half of the practice.
- Substantially met: USCIS provided evidence that satisfied a large portion of the practice.
- Met: USCIS provided evidence that satisfied all of the practice.

We shared our initial assessment with USCIS, obtained feedback and additional supporting documentation, and then summarized the final results for our report.

We conducted this performance audit from May 2015 through July 2016, 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.

---

# Appendix II: Management of Agile Software Development for USCIS ELIS

---

Completing planning for software releases prior to initiating development and ensuring software meets business expectations prior to deployment

This appendix describes in more detail our evaluation of the eight key practices for managing and implementing Agile software development. It does not present new findings. Rather, the information detailed in this appendix is intended to assist USCIS in implementing the recommendations described in our report.

For the Transformation Program, USCIS has modified the Department of Homeland Security's (DHS) traditional system development life cycle to accommodate the requirements of a program implementing an Agile software development approach. This modified approach includes two primary points of review that take place at the beginning and end of the development of a portion of software, called a release, before it is made available to users. These points are the release planning review, during which the program plans for the software release, and the release readiness review, during which the program ensures that the software that has been developed meets business expectations prior to deployment.

## Release planning review

The *USCIS Transformation Program Systems Engineering Life Cycle Tailoring Plan* tailors DHS's project planning review, systems definition review, and preliminary design review out of the development life cycle and replaces it with the release planning review. According to *USCIS Agile Development Policy*,<sup>1</sup> each release cycle will include a release planning review. This review is intended to communicate what is planned for the release and ensure that all information technology (IT) and other resources are committed to support it. According to the plan, to ensure a business decision is made as to whether the investment in the release cycle is justified by the expected results (i.e. capabilities to be produced), a release should not proceed to release activities (e.g. development or testing) until it has secured release planning review approval.

To support this business decision, *USCIS Agile Development Policy* requires the development and approval of a set of core release planning review documents. The core documents for release planning are:

---

<sup>1</sup>CIS-OIT-001.



- release capabilities and constraints;<sup>2</sup>
- team process agreement;<sup>3</sup>
- definition of done;
- project oversight plan;<sup>4</sup>
- critical task schedule;
- test and evaluation plan; and
- privacy impact assessment, if required.

The program's tailoring plan identifies additional artifacts required for the release planning review. These additional artifacts include an update to the acquisition plan and life cycle cost estimate.

The program prepared the required documents articulated in *USCIS Agile Development Policy* to support its approval to proceed with development of USCIS ELIS for system releases 5.0 through 7.0. Specifically, for the five major releases planned as of February 2016, the program had developed and reviewed capabilities and constraints, a team process

---

<sup>2</sup>The capabilities and constraints document defines the mission capabilities to be developed for a release in support of a specific product line (i.e. Deferred Actions for Childhood Arrivals). Typically, capabilities are documented via a traceability matrix that specifies the specific sub-features for development and whether the sub-feature is new development, re-use of existing functionality, similar to existing functionality but requiring some re-work, or not applicable/not to be developed in the release. This document also defines constraints such as standards (i.e. enterprise architecture compliance), time frames, architecture and design, performance expectations (i.e. system response time), and other areas (i.e. reliance on existing program and technical management structures that were put in place to support legacy USCIS ELIS development).

<sup>3</sup>USCIS policy does not define the purpose or provide guidelines for completing a team process agreement. However, according to the Chief of the Applied Technology Division, the team process agreement is generally the agreement within the team of how they will work with each other. Among other things, the team process agreements we reviewed defined the development methodology to be used (i.e. Scrum), length and number of iterations, number of teams and team structure, foundational USCIS Agile practices, and Agile tools available to teams.

<sup>4</sup>USCIS policy does not define the purpose or provide guidelines for completing a project oversight plan. However, according to the Chief of the Applied Technology Division, the project oversight plan generally addresses how the team will interact with the oversight groups. Among other things, the project oversight plans we reviewed defined the planned costs for each release, general risk mitigation procedures, and information radiators, such as physical task boards or feature progress charts.

agreement that included the definition of done, the project oversight plan, and the critical task schedule. The test and evaluation plan and privacy impact assessment are documents that are updated with each release, as needed, and therefore do not require a unique submission as part of each release.

In addition to the required documentation, the program office also provided evidence for approval from the Chief Information Officer (CIO) to proceed with development of all planned releases. Specifically, the program office provided evidence of approval for release 5.0 in May 2013 and subsequent extensions, release 5.1 in November 2014, releases 6.1 and 6.2 in April 2015, and release 7.1 in July 2015. As part of this review and approval, a quality assurance analyst reviewed the required documents cited.

However, system development for individual releases began prior to completion of the release planning review. Specifically, for four of the five major releases, development began prior to the designated authority's approval to begin development. Table 7 describes the date on which approval was granted relative to the start of development.

**Table 7: Release Planning and Development Dates**

Release	Release planning review approval date	Date on which development began
5.0	5/28/2013	6/12/2013
5.1	11/5/2014	10/1/2014
6.1	4/7/2015	3/18/2015
6.2	4/7/2015	3/4/2015
7.1	7/30/2015	7/22/2015

Source: GAO analysis of USCIS documentation | GAO-16-467.

According to the Chief of the Applied Technology Division in the USCIS Office of Information Technology (OIT), a release planning review provides authority for the program to work for the next 6 months. He added that it is not for a specific scope because scope can change. Moreover, this official stated that a release planning review is used to execute contracts and any delays in the review would impact the ability of development teams to continue developing software code. This official stated that this partly contributed to development activities occurring prior to release planning review approval.

However, we found that the release planning review period did not always align with a six-month period of development. For example, release planning review approval for releases 6.1 and 6.2 was granted in April 2015. Release planning review approval was then granted for release 7.1 only three, rather than six, months later in July 2015. Further, the intention of the release planning review, as articulated in USCIS policy and the program tailoring plan, is to approve functionality for a specific product line, not for general six-month development periods.

In addition to the sequencing of development, the program did not provide evidence that the life cycle cost estimate or acquisition plan were updated during the release planning review. The Chief of the Program and Resource Management division in OTC stated that the program acquisition plan is updated annually rather than as a part of the release planning review. Moreover, in written responses, the program stated that the life cycle cost estimate is also only submitted as a formal update on an annual basis. Although the program stated that the life cycle cost estimate is routinely updated with actual costs, USCIS did not provide evidence to support this statement. Release planning review memos also included no evidence that these additional documents were updated or discussed.

Collectively, the practices being followed by the program for a release planning review and the policy and guidelines governing this process do not align. This includes the artifacts produced and updated as part of this process. The USCIS CIO concurred with our assessment that USCIS policy and guidance needs to be updated to reflect such inconsistencies between policy and practice.

### **Release readiness review**

The *USCIS Transformation Program Systems Engineering Life Cycle Tailoring Plan* tailors the production readiness review out of DHS's system development life cycle and replaces it with the release readiness review. According to this plan, release readiness reviews are conducted as needed and are focused on ensuring all elements of the release are complete including testing, documentation, approvals, accreditations, and provisions for sustainment. The plan designates the release manager, in consultation with other stakeholders, to approve that a release meets business expectations prior to deployment (e.g. be made available for use).

To support this decision, *USCIS Agile Development Policy* also requires the development and approval of a set of core release readiness review documents. The core documents for release readiness are:

- system design document;
- automated and manual build and installation scripts;
- automated and manual test scripts;
- automated and manual deployment scripts;
- internal change control board or change control board package
- security plan; and
- security assessment report.

The program documented some artifacts required for the release readiness review and was granted approval to proceed with deployment for all major releases for USCIS ELIS. As of February 2016, major releases of USCIS in production included releases 5.0, 5.1 and 6.1. In support of these reviews, the program provided evidence that system design documentation and automated and manual scripts were submitted as part of release readiness reviews.

While the program documented some artifacts required for release readiness review, it did not provide evidence of having reviewed or updated other required artifacts. Specifically, the program did not provide an updated security assessment report, security plan, or change control documentation. Moreover, although the program provided manual and automated scripts, it provided no evidence that the actual scripts were assessed as part of the release readiness review. For example, as part of the approval granted for limited deployment of functionality in support of release 6.1, officials assessed a general test summary report, but the program did not provide evidence that actual automated and manual build, installation, test, or deployment scripts were reviewed. Instead, officials discussed testing in general prior to deployment, such as whether performance or end user testing had been completed.

The USCIS CIO stated that policy and guidance reflect an old process. This official explained that the program is no longer holding a release readiness review for each release because deployments (e.g. enhancements) occur weekly. Instead, the decision to hold a release readiness review is based on his discretion as USCIS CIO, although a review is still held prior to deploying a major release. The Chief of the Applied Technology Division added that approval to complete a release

readiness review and deploy a major release is a business, not a technical, decision. Both this official and the USCIS CIO explained that, from their perspective, all of the technical work associated with testing the system has taken place well in advance of a release readiness review. For example, the USCIS CIO stated that the continuous integration pipeline allows for a regular build of the code, in which tests are constantly run to ensure the software works as intended.

As with the release planning review, we found that collectively the practices being followed by the program for a release readiness review and the policy and guidelines governing that process do not align. This includes the artifacts produced and updated as part of this process. The USCIS CIO concurred with our assessment that USCIS policy and guidance needs to be updated to reflect such inconsistencies between policy and practice.

Adhering to the principles of the framework adopted for implementing Agile software development

The *USCIS Transformation Program Systems Engineering Life Cycle Tailoring Plan* does not identify the specific Agile methodology or document the basis for selecting the specific methods. Rather, the tailoring plan states that the USCIS CIO (e.g. Lead Technical Authority) is responsible for providing guidance and direction related to all technical matters and IT process issues, including Agile and lean methodologies, the systems engineering life cycle processes, and continuous integration and continuous delivery of code to meet planned capabilities in USCIS ELIS. Rather than identifying a specific methodology, this plan discusses the tailored review approach under an Agile software development methodology.

*USCIS Agile Development Policy* also does not prescribe a particular methodology for Agile software development. Specifically, USCIS policy states that current policy and standards are silent on the specific Agile methodologies to be used and on the appropriate guidelines and controls for Agile projects. This policy instead is intended to provide more detailed direction to USCIS on the use of Agile methods. In particular, the policy considers projects to be Agile if they meet select requirements such as frequent delivery and the assignment of a product owner (see the next section on roles and responsibilities for a further discussion of the product owner). In the absence of a defined Agile software development methodology, USCIS policy and guidance calls for the creation of a team process agreement during release planning to articulate the methodology agreed upon between the development teams and the business.

The team process agreements for planned major releases (e.g. 5.0, 5.1, 6.1, 6.2, and 7.1) stipulate that teams will adhere to the Scrum framework. A commitment to this framework is further reinforced in consolidated release assessments prepared by the Quality Assurance Team.

Scrum is one approach for implementing Agile software development. Scrum's roles, events, artifacts, and rules, which can collectively be considered its principles, are defined in the Scrum framework.<sup>5</sup> The framework identifies basic rules to guide a team in the application of various events that are organized into a series of "sprints."<sup>6</sup> These events (e.g. sprint planning, daily Scrum, sprint review, and sprint retrospective) are to occur once each sprint and the daily Scrum is to occur each day. Specifically, the *Scrum Guide* defines the following events:

- Sprint planning: Sprint planning defines what will be delivered in the software increment<sup>7</sup> resulting from the upcoming sprint and how the work needed to deliver the increment will be achieved. The development team<sup>8</sup> defines the functionality that will be developed during the sprint.
- Daily Scrum: The daily Scrum is a 15-minute meeting held at the same time and place each day by the development team to synchronize activities and create a plan for the next 24 hours. This is accomplished by inspecting the work completed since the last day's Scrum and forecasting the work that can be done before the next one.

---

<sup>5</sup>Ken Schwaber and Jeff Sutherland, *The Scrum Guide:™ The Definitive Guide to Scrum: The Rules of the Game* (July 2013).

<sup>6</sup>A sprint is a set period of time, for example, two weeks, during which the development team is expected to complete tasks related to the development of an increment of software.

<sup>7</sup>An increment is a piece of working software that adds to previously created increments. A collective set of increments comprise a software release.

<sup>8</sup>Development team is the role within a Scrum team accountable for managing, organizing, and doing all development work required to create a releasable increment of product every sprint.

- **Sprint review:** A sprint review is an informal meeting held at the end of the sprint to inspect the software increment and adapt the backlog<sup>9</sup> if needed. The Scrum team<sup>10</sup> and stakeholders collaborate about what was accomplished in the sprint and decide on what will be accomplished next.
- **Sprint retrospective:** A sprint retrospective occurs after the sprint review and prior to the next sprint planning meeting. The retrospective is an opportunity to discuss how the last sprint went with regard to people, relationships, process, and tools; identify and order the major items that went well and potential improvements; and create a plan for implementing improvements to implement in the next sprint.

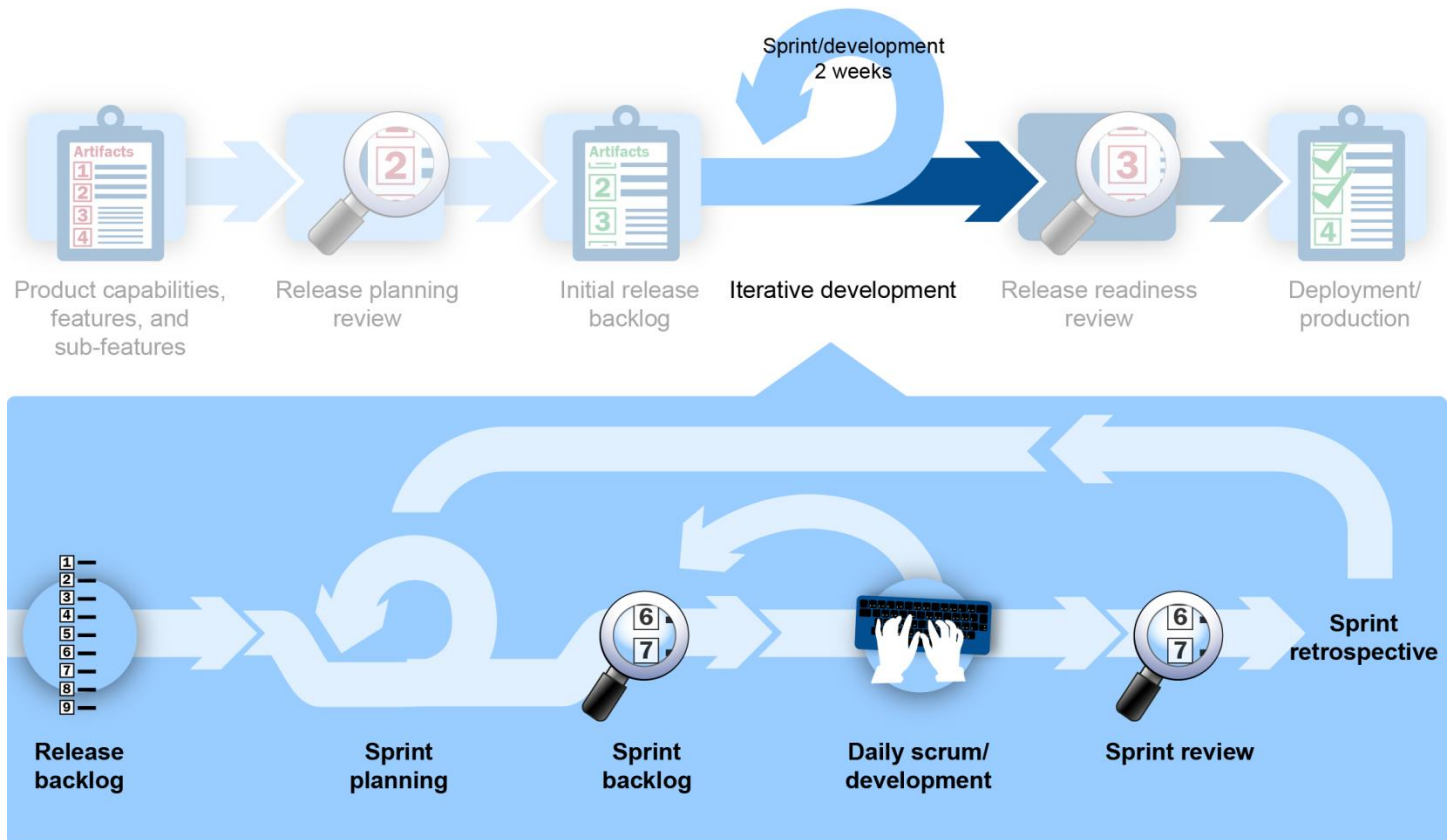
See figure 8 for a depiction of a traditional Scrum process flow within the release planning and readiness review processes and time frames specific to the development of USCIS ELIS.

---

<sup>9</sup>The product backlog is an ordered list of the work to be accomplished in order to create, maintain, and sustain a product. In the case of USCIS, the product backlog is broken into a series of major and minor release backlogs. A release backlog includes all user stories and the associated features to be delivered in a release. A sprint backlog includes stories pulled from the release backlog to be delivered in a sprint.

<sup>10</sup>The Scrum team is a self-organizing group consisting of a product owner, development team, and Scrum master. Product owner is the role in Scrum accountable for maximizing the value of a product, primarily by incrementally managing and expressing business and functional expectations for a product to the development team(s). A Scrum master is the role within a Scrum team accountable for guiding, coaching, teaching and assisting the team and its environments in a proper understanding and use of Scrum.

Figure 8: Scrum Process for USCIS ELIS Release Process



Source: GAO analysis of U.S. Citizenship and Immigration Services documentation. | GAO-16-467

USCIS ELIS development teams consistently held daily Scrum sessions. Specifically, according to consolidated release assessments produced by the Quality Assurance Team, a daily Scrum took place nearly every day.

However, while daily Scrums occur regularly, consolidated release assessments show that development teams are not consistently holding sprint planning, sprint review, or sprint retrospective discussions. Starting with the development of releases 6.1 and 6.2, the program changed sprint review procedures so that a review is held every other sprint, instead of each sprint, as prescribed by Scrum. Further, consolidated release assessments show that retrospectives are being conducted in an erratic manner, instead of at the end of each sprint, as prescribed by the Scrum framework and in team process agreements. For example, one



development team went nearly five months without conducting a retrospective. In another case, a development team held a retrospective on August 25, 2015, and then not again until October 21, 2015. Collectively, only two of the 12 development teams working on USCIS ELIS held a retrospective each sprint. In the case of those two teams, a retrospective was only held each sprint starting in July 2015. Prior to July 2015, they were held less frequently.

In addition, within each event, teams are not consistently adhering to the basic principles of the event. The consolidated release assessments indicate that teams adhere to certain principles, such as involving stakeholders and obtaining feedback during the sprint review. Further, acceptance criteria is defined and discussed by the development team as part of sprint planning. However, other principles are not consistently performed. For example, development teams are not implementing improvements identified during the team retrospective at least 30 percent of the time. Moreover, as discussed in the next subsection addressing roles and responsibilities, product owners are not always available to the team for events, such as sprint planning. Consolidated release assessments noted that the product owner is absent from sprint planning over 20% of the time.<sup>11</sup>

The program did not adhere to principles of the Scrum framework because USCIS policy and guidance does not consistently align with those principles. According to the Chief of the Capability Delivery Division within OTC, the program uses some aspects of the Scrum framework, but also follows the principles of Agile software development by continuously tailoring practices to align with the concept of lean software development. He added that the program should not be held accountable to the *Scrum*

---

<sup>11</sup>In answering the question of whether the product owner attended planning, consolidated release assessments found 57 percent of the time they did, 21 percent of the time they did not, and 21 percent of the time this question was not applicable. Guidance for completion of the consolidated release assessment notes that this response can be marked as a “yes” if a delegate attends as long as delegate explicitly states that he can make decisions. In a written response, the Chief of the Delivery Assurance branch in OIT stated that the team has monitored sufficient USCIS ELIS releases to state that product owner involvement is a general rule of behavior for all of the development teams, but there are exceptions to every rule. He added that, given the size of the meetings and number of attendees involved, it is easy to make errors regarding roles.

*Guide*<sup>12</sup> principles because this framework is not meant to provide major government investments with guidance on navigating through acquisition oversight and regulatory requirements. The USCIS CIO added that Scrum is not a USCIS requirement and some teams can use other methods, such as Kanban or a hybrid process such as Scrum and Kanban.<sup>13</sup> This official stated that USCIS has defined the characteristics that the team's process has to follow in order to be considered Agile, but that teams are encouraged to find their own process that works best. However, the USCIS CIO added that each Agile framework includes its own rules that make it successful and that teams should be more or less following the rules for the framework.

While we recognize that USCIS policy allows for team flexibility in Agile software development practices and the need for continuous improvement of those practices, Scrum is the framework teams have adopted for development of USCIS ELIS and it is reflected throughout various program documents. This was reiterated by the Quality Assurance Team and is reflected in the consolidated release assessments.<sup>14</sup> The *Scrum Guide*<sup>15</sup> is clear that Scrum's overall roles, artifacts, events, and rules are unchangeable and although it is possible to implement only parts of Scrum, the result is not Scrum. Scrum exists only in its entirety and functions as a container for other techniques,

---

<sup>12</sup>Ken Schwaber and Jeff Sutherland, *The Scrum Guide:™ The Definitive Guide to Scrum: The Rules of the Game* (Jul. 2013).

<sup>13</sup>Agilealliance.org, a nonprofit organization committed to advancing Agile development principles and practices, defines the Kanban method as an approach to continuous improvement that relies on visualizing the current system of work scheduling, managing "flow" as the primary measure of performance, and whole-system optimization. As a process improvement approach, it does not prescribe any particular practices. The focus of Kanban is to optimize the throughput of work by visualizing its flow of work through the process, limiting work in progress, and explicitly identifying policies for the flow of work. Kanban has distinct differences from other popular Agile methodologies, primarily the fact that it is not based on timeboxed iterations, but rather allows for continuous prioritization and delivery of work.

<sup>14</sup>Consolidated release assessments allow for a quality assurance analyst to document whether a team is adhering to the practices of Scrum, Kanban, or a combination of the two. The consolidated release assessment for each team developing USCIS ELIS document if the team is adhering to Scrum practices.

<sup>15</sup>Ken Schwaber and Jeff Sutherland, *The Scrum Guide:™ The Definitive Guide to Scrum: The Rules of the Game* (Jul. 2013).

Defining and consistently  
executing appropriate roles  
and responsibilities for  
individuals responsible for  
development activities

methodologies, and practices. While the program office may find it inappropriate to be held accountable to the *Scrum Guide*,<sup>16</sup> this is the authoritative source that defines the practices and principles that govern Scrum. Allowing ad hoc deviations from Scrum framework events, whereby some are honored and others are not, results in reduced transparency and lost opportunities for learning and adaptation. For example, without consistent retrospectives during each sprint, the development team will not be able to discuss and commit to potential improvements to implement in the upcoming sprint, thereby impacting team performance.

According to the *Scrum Guide*, the Scrum team consists of a development team, a product owner, and a Scrum master to optimize flexibility, creativity, and productivity. Scrum team roles and their related responsibilities consist of, among other things:

- Development team: The development team is responsible for delivering a software increment each sprint. The only position title in a development team is to be that of the developer—there are no exceptions to this rule. Optimal development team size is between three and nine team members.
- Product owner: The product owner is to be the person responsible for maximizing the value of the product, the work of the development team, and the backlog. How this is accomplished may vary widely across organizations, Scrum teams, and individuals.
- Scrum master: The Scrum master is to be responsible for ensuring that the principles of Scrum are understood and enacted by ensuring that the Scrum team adheres to Scrum theory, practices, and rules. In addition, the Scrum master is a go-between for the Scrum team with those outside the team. The Scrum master does not manage or oversee the Scrum team.

---

<sup>16</sup>Ken Schwaber and Jeff Sutherland, *The Scrum Guide*.<sup>TM</sup> *The Definitive Guide to Scrum: The Rules of the Game* (Jul. 2013).

### Development team

Based on our review, we found that the program did not consistently execute two basic principles as defined in the *Scrum Guide*<sup>17</sup> when standing up development teams: the team should be between 3 and 9 people and team members should be referred to solely as ‘developers.’

According to the backlogs for releases 6.1, 6.2, and 7.1, along with the supporting team rosters, there are 12 development teams working on USCIS ELIS. According to the team rosters provided as of August 2015, 4 of the 12 development teams include, or plan to include, more than 9 team members. The program office also stipulates that management and technical leads are members of the development teams. With the addition of these team members, an additional 5 development teams (9 in total) include, or plan to include, more than 9 team members. This finding was further substantiated in resource expenditure reports. For example, in April 2015, 14 team members charged hours for one development team.

The Chief of OTC stated that the resources (i.e. staff) for the contractor development teams are divided into teams in order to meet contractual obligations. The program manager in OIT stated that the contracts were written with the expectation that the standard team size would be between 7 and 9 staff. This official explained that some people might be moving across teams, so the count of the development team size might change over time. We requested additional evidence from the program to help reconcile this matter, but the program did not provide the requested information.

In addition to team size, contracts and the program team roster define specific positions for the development team members. For example, contracts identify team members as a system architect, test engineer, application programmer, database specialist, business process reengineering, and other such titles. Development team rosters further classify members as developer, tester, 508 tester, business analyst, management lead, and technical lead.

---

<sup>17</sup>Ken Schwaber and Jeff Sutherland, *The Scrum Guide:™ The Definitive Guide to Scrum: The Rules of the Game* (Jul. 2013).

The program manager in OIT stated that all individuals in the development teams are first considered developers, then each individual has an area of focus. This official reiterated that, while development team members may carry certain titles, each team member is performing all of the functions necessary for the team rather than limiting their work to their predefined role. The Chief of the Applied Technology Division in OIT added that each development team member has different skills and may specialize in an area in order to meet the different needs of the development team. However, this official confirmed that development team members are referred to by specific titles beyond simply 'developer.' As a result, in delineating team roles, the program may not fully embrace the ideas underlying the new approach.

### **Product owner**

The *Scrum Guide*<sup>18</sup> and *U.S. Digital Services Playbook* recommend assigning a product owner and holding that person accountable. To effectively perform this role, there must be a single product owner who has appropriate authority and responsibility to assign tasks and work elements; make business, product, and technical decisions; and be accountable for the success or failure of the overall service. The product owner is ultimately responsible for how well the service meets the needs of its users.

To supplement the traditional product owner role, OTC initially drafted a management model that further defined the product owner role and responsibilities. According to this management model, which describes the program's approach for managing USCIS ELIS, the product owners should be assigned responsibility for no more than four development teams.

Product owners are granted the necessary authority and responsibility to perform their duties. The two product owners assigned to oversee releases 6.1, 6.2, and 7.1 stated that they retain responsibility for the release backlog and user stories within that backlog, including accepting and prioritizing user stories. The program management model reinforces this assertion and states that the product owner is responsible for

---

<sup>18</sup>Ken Schwaber and Jeff Sutherland, *The Scrum Guide:™ The Definitive Guide to Scrum: The Rules of the Game* (Jul. 2013).

ensuring the development of a USCIS ELIS release that meets the vision and business requirements of USCIS. It also notes that the purpose of this position is to serve as a single point of contact for the development teams.

However, while product owners assume authority for each release, product owners are responsible for over 4 development teams. Specifically, the product owner for release 7.1 was at times responsible for work being conducted by all 12 development teams working on USCIS ELIS. The other product owner, responsible for releases 6.1 and 6.2, was at times responsible for work being performed by 10 development teams.

The two product owners stated that the number of development teams they work with has not presented any challenges, but the results of the Quality Assurance Team's consolidated release assessments, as well as prior product owner testimony and our own observations, indicate otherwise. During development of release 5.0, one product owner stated that it was a challenge to accommodate more than one team and she had to stagger her time between the teams to support sprint planning and maintain meaningful dialogue between the product owner and the team. In addition, the consolidated release assessments indicate that product owners did not attend 21 percent of sprint planning meetings (26 of 122 responses). This idea was reinforced in our own observations of daily stand-up meetings and sprint planning. Our observations covered sprint 56 only and therefore are not a reliable indicator of broader concerns, but product owner availability was an issue voiced by development team members and observed by our team during that time period.

The Chief of OTC stated that, when the product owner role and responsibilities were first defined, the program office may have felt that only 4 development teams were needed to develop a product line. However, in reality, more development teams are necessary to complete a product line. As such, the span of control for the product owner has increased. To accommodate and support this increased span of control, the Chief added that, in December 2015, OTC revised its reporting structure such that product managers now report to the product owners to help extend the product owners' reach (previously product owners had no staff reporting to them). The Chief of OTC noted that the product managers assume more of the work of the product owner but have not assumed product owner authority.

The Chief of OTC provided an update to the OTC management model that removes the 4 development team limitation on product owner

responsibilities. However, removing this restriction does not address the larger concern that the more development teams a product owner is responsible for, the less time the product owner is able to spend with each team. Consequently, this can impact product owner effectiveness in performing his or her assigned duties. The addition of a product manager may help to mitigate the issue, but not granting those individuals authority adds another layer of communication between the development team and product owner. This added layer of communication may, in turn, impact team performance, as decisions still need to be made by a product owner.

According to USCIS guidance, lack of inclusion and transparency with the development team's decision making and processes can result in a disengaged product owner, or one that makes decisions without adequate consideration of challenges faced by the team. Moreover, as we discuss later, the program has faced challenges in completing work within committed timeframes. Product owner availability may be a contributing factor.

### **Scrum master**

Scrum teams did not include an individual explicitly designated as a Scrum master. The Chief of OTC stated that, prior to creating the new position of product manager, project managers were expected to assume the role of Scrum master. This expectation was further corroborated in some contractor documentation. For example, one of the contractor quality management plans states that the contractor recognizes the benefit that the government Scrum masters provide in managing the team. However, according to the Chief of OTC, the program determined that project managers were not effective as Scrum masters because the development team members, who were contractors, did not take direction from them.

Instead, the Chief of OTC stated that an expectation was set for development teams to perform autonomously and provide their own Scrum masters, or the equivalent. However, the program did not provide evidence that such a role is assumed by the contractor or that such an expectation was conveyed to the contractor by the program office. The need to set clear expectations between the contractor and government in contracting for program services is further discussed in the contract management section of this report.

---

Identifying users of the system  
and involving them in release  
planning activities

According to leading practices for Agile software development,<sup>19</sup> early on a program should determine who will be the users of the system and involve all types of users in planning the user stories. This approach helps ensure that the system reflects the various tasks that will be conducted by the users. General users of USCIS ELIS fall into three general categories: external customers (e.g. applicants), internal users (e.g. USCIS adjudicator), and external agency users (e.g. Department of State). In this case, the term “customer” refers to an individual, representative, or organization applying for immigration benefits or related services.

OTC has defined and documented internal user roles for USCIS ELIS. For example, the program maintains a set of user access roles that loosely correspond to the users of the system within USCIS, such as a supervisor or an adjudicator. According to one product owner, this user access list is added to as subject matter experts define additional roles, not already captured, as part of planning for a new release.

External customers are also identified in release planning documentation. For example, process scenarios provided by OTC’s Business Integration Division identify the customer or representative as a user of the system. Such process scenarios might reflect a future work flow for release 6.1 (processing of deferred action for childhood arrivals applications).

The program provided evidence that both internal users and external customers are involved in release planning or development activities. For example, in preparation for release 7.1, the program included 50 representatives from the Field Operations Directorate, 13 representatives from the Service Center Operations Directorate, and a host of other representatives from various USCIS offices. The program also provided summaries from focus groups held with external customers in September 2014 and October 2015, along with more recent evidence of ongoing conversations.

---

<sup>19</sup>Software Engineering Institute, CMMI® for Development, version 1.3, CMU/SEI-2010-TR-033 (Nov. 2010); ISO/IEC/IEEE, *Systems and Software Engineering—Developing User Documentation in an Agile Environment, corrected version*, ISO/IEC/IEEE 26515:2012(E) (Mar. 15, 2012); U.S. Digital Service, Playbook (version pulled Dec. 18, 2015).



However, the program did not provide evidence of having defined or considered external agency users in release planning. Moreover, there are no user stories in the release backlogs that clearly call out functionality to be built in support of external agency users. Further, the program did not provide evidence that such users were included in planning or development activities prior to release deployment.

The Chief of the Capability Delivery Division in OTC stated that individuals from agencies that interface with and access USCIS ELIS were not involved in release planning because such users only access information. Further, the Chief of OTC explained that external organizations gain access to data from USCIS ELIS via a system interface, the Person Centric Query System, which is supported by another piece of infrastructure within USCIS, the Enterprise Service Bus. See appendix IV for more information on these additional interfaces. However, by omitting these users from release planning discussions, the program risks overlooking functionality that USCIS ELIS could provide in support of the respective agency missions.

## Writing well-structured user stories

User stories should identify user roles, include estimates of complexity, take no longer than one sprint to complete, and describe business value. Based on our review of the backlogs for releases 5.0, 5.1, 6.1, 6.2, and 7.1, as of March 2016, user stories identified a user role and contained an estimate at least 90 percent of the time. However, user stories did not define the associated business value. Further, of the approximately 1,000 user stories tracked by the Quality Assurance Team, over 30 percent were not sized appropriately and took over a full sprint to develop.

### Defining a single user role

According to our review of release backlogs, the program has shown improvement in defining the user role over time and has substantially addressed this practice with its most recent set of user stories. The backlog for release 5.0 does not differentiate between a typical user story and other work, such as work associated with 508, interface, and end-user testing. For example, one user story reads “Interface: Develop Person Search to interface with PCQS 4.0.1.” About 37 percent of user stories in the backlog for release 5.0 reflect either other work or user stories that are not assigned to user roles. Since then, the program has migrated to a new software tool that allows for differentiation between user stories, enhancements to existing functionality, and bugs. Our review of user stories for 5.1 through 7.1 as documented in this new tool indicates that less than 10% of user stories do not define a user role.

### **Establishing a user story estimate**

The program has shown improvement in including user story estimates over time, and has substantially addressed this practice with its most recent set of user stories. Most user stories did not previously include estimates that reflect the amount of work associated with the story relative to other user stories. Specifically, 231 of the 1,343 user stories contained in August 2015 release backlogs did not include an estimate. Of these, more than 80% of user stories for release 7.1 did not include an estimate. In addition, updated user stories that were provided in November 2015 for releases 6.1, 6.2, and 7.1, included no estimates. According to the program office, when OTC migrated from one user story management tool to another, data was compromised, which resulted in user story estimates being removed. Since then, the program has taken steps to reconcile the matter. In particular, backlogs for releases 6.1, 6.2, and 7.1, provided in March 2016, show that only 56 of 980 (6 percent) of user stories did not include an estimate of the amount of work associated with the story.

### **Appropriately sizing the user story**

User stories are taking a full sprint or longer to be completed, indicating that the program may be underestimating the amount of work and time required to complete it for user stories. Specifically, approximately 30% of user stories (287 of 951) contained in the Quality Assurance Team's November 2015 documentation of user stories took more than a full sprint (i.e. 14 days) before gaining acceptance.

The Chief of OTC speculated that user stories may take longer than a full sprint to be developed due to constraints outside of the control of a development team. For example, a user story may require testing with an interface in order to pass the associated acceptance criteria. However, if access to the interface is unavailable, completion of the story will be delayed. Nevertheless, the program did not provide evidence to support specific reasons for why so many user stories took more than a full sprint to complete.

In addition, while factors outside the program's control might be one reason that user stories are taking longer to be developed, there may be

internal reasons for a delay, such as resources shifting from one development team to another, unavailability of the product owner, issues with the developer's physical environment,<sup>20</sup> or an inadequate estimate of the work needed to complete a user story. Nevertheless, development teams should learn over time how to better estimate the work required to complete individual user stories, leading to better results. Instituting additional controls in the development process could help to identify potential causes and limit the number of user stories that exceed a full sprint.

### **Defining the business value**

Most user stories do not define a business value. Program officials stated that requirements for defining user stories that are described in USCIS guidance should be updated to be less prescriptive. USCIS officials stated that the definition for a user story does not need to include information about the value to the business or the actual user because ongoing interactions between the product owner and development team help address questions related to value. Officials further explained that development teams are familiar enough with the stories that they inherently understand who the story applies to and what value it serves. The program did not provide evidence to support that the value of a user story is continuously discussed with the development team; however, it is reasonable to assume this occurs based on the level of collaboration among business and development team staff. Nonetheless, defining user story value is not solely for the benefit of a development team, but also for a product owner, and affords transparency to those less integrated with the process, such as program management, in understanding the business need.

Prioritizing user stories to maximize the value of each development cycle

*USCIS Agile Development Policy* and guidance state that release planning should yield a prioritized backlog of work. A product owner is responsible for providing business direction to the team by managing and

---

<sup>20</sup>Each developer accesses a virtual machine, software that allows a single host to run one or more guest operating systems, on which they perform various development activities such as writing software code or associated tests. In order to perform these activities, that environment must be accessible (i.e. virtual machine physically boots up) and properly configured (i.e. current version of an operating system or software tools are loaded on the machine).

prioritizing the release backlog and making decisions about what to build and in what order. Guidance also recommends that the product owner prioritize the release and sprint backlogs based on risk, value, and business priorities. It suggests that failing to place the highest risk items of high business value first can jeopardize the ability to deliver a release successfully and that the product owner should make trade-off decisions for balancing risk and value. In addition, the *Scrum Guide*<sup>21</sup> states that the product owner should order user stories in the backlog with more detail for near-term stories than long-term stories. Collectively, USCIS policy and guidance, along with the *Scrum Guide*,<sup>22</sup> allow the product owner complete discretion and flexibility in determining what constitutes value and the order in which user stories are prioritized.

Product owners provided an overview of the prioritization process they follow. According to the product owners for releases 6.1, 6.2, and 7.1, user story priorities are based on the need to develop specific features associated with an upcoming release. The product owner for release 7.1 added that user stories are prioritized based on a release road map. According to the product owner, the road map lays out a sequence of features to develop, and then user stories are defined and placed into iterations/sprints. The product owner stated that user stories are prioritized based on where in the future workflow a particular task occurs. The goal is for a major release (i.e. product line) to establish a basic end-to-end workflow. The product owner added that features reflected earlier in the workflow do not necessarily provide a greater value. Instead, these features are a higher priority because they must occur before a subsequent feature can occur on the end-to-end workflow.

The product owner for releases 6.1 and 6.2 confirmed this approach, stating that user stories are prioritized by feature, with the feature priorities reflected in release road maps. According to the product owner, the development teams are expected to work according to the feature priorities. The product owner stated that the priority order for features is based first on those needed for end-to-end processing of an application.

---

<sup>21</sup>Ken Schwaber and Jeff Sutherland, *The Scrum Guide:™ The Definitive Guide to Scrum: The Rules of the Game* (Jul. 2013).

<sup>22</sup>Ken Schwaber and Jeff Sutherland, *The Scrum Guide:™ The Definitive Guide to Scrum: The Rules of the Game* (Jul. 2013).

For example, the first feature needed might be account creation. After there is a product that can perform end-to-end processing and pass testing, the product owner may begin to prioritize additional new features. This product owner added that any work associated with a new interface is typically developed sooner as it may be riskier to complete. The product owner stated that the teams only prioritize features; they do not prioritize sub-features or the user stories that comprise those sub-features.

The product owner for releases 6.1 and 6.2 stated that work for these releases has undergone a number of changes that impacts traceability between the road map and release backlog. According to the product owner, initially, development focused on a particular set of functionality associated with a product line. However, with changes in the external environment, the program office stopped development on this product line and shifted attention elsewhere. Following additional external events, the product owner, at the recommendation of the program office, shifted back to the original focus of development.

In addition, the product owner explained that some features were built across a number of sprints due to the availability of internal users. According to the product owner, she initially prioritized the development of features based on how she, in conjunction with the program office, determined was most appropriate. However, with increased access to other USCIS personnel, such as experts from service center operations, the product owner revisited her prioritization of user stories.

The program has provided product owners with significant flexibility in making development decisions and the order in which development occurs, and product owners demonstrated that they are taking steps to establish the user story priorities that they determine are appropriate and maximize value.

## Setting outcomes for Agile software development

In our prior work on effective Agile software development practices,<sup>23</sup> we have found that a key practice for the successful adoption of Agile software development is to identify measurable outcomes, not outputs, of

---

<sup>23</sup>GAO, *Software Development: Effective Practices and Federal Challenges in Applying Agile Methods*, [GAO-12-681](#) (Washington, D.C.: Jul. 27, 2012).

what the program wants to achieve using the approach. An example of this practice is creating a vision for project outcomes (such as a decrease in processing time by a specific percent in a set time), rather than outputs (such as the amount of code produced).

The Transformation Program has not defined or set goals for the transition to Agile software development. Officials from the Quality Assurance Team stated that the goal of all metrics collected is to create a full picture of the strength of the USCIS ELIS process and product quality. These officials added that the program's ability to deploy software frequently demonstrates that the Transformation Program is improving its ability to develop software. In addition, the Chief of OTC stated that the outcome or goal for the program is to deploy a product line within the baseline cost, schedule, and performance parameters. Furthermore, the USCIS CIO stated that Agile software development is a "best practice" for many reasons. The program's goal is to use best practices wherever possible.

Collectively, all of the various responses to the question of the goals and associated outcomes for the transition to Agile software development supports the fact that the program did not establish a well understood goal, or set of goals. There also is a gap in expected outcomes. For example, the program did not provide evidence of having defined, and program officials did not talk about, how often they would like to deploy software or what level of process and product quality the program hopes to achieve. Without a sense for the goals and expected outcomes for Agile software development, while the program may be able to monitor progress, there is no basis against which to evaluate this progress to determine the success of Agile software development in the agency.

---

Monitoring and reporting on program performance through the collection of reliable metrics

The US Digital Services Playbook<sup>24</sup> states that a program should develop metrics in order to measure performance. The playbook, along with other guidance,<sup>25</sup> identifies metrics such as how well the service is meeting user needs at each step of the service, the quality of software code being developed, the progress of development from a release or program perspective, and the consistency of progress of each development team.

OTC and OIT are collecting a number of metrics to monitor program performance and are routinely discussing these metrics at weekly and monthly reviews. The metrics include

- Ability of service to meet user needs: Customer satisfaction surveys.
- Code quality: Production defects and incidents, automated code scanning results, code issue counts, and test activity timelines.
- Progress of development for a release: Cumulative flow diagram, burnup chart, rate of user story acceptance, and rate of ticket acceptance.
- Consistency of team progress: velocity.<sup>26</sup>

Moreover, in March 2015, the DHS Office of the CIO Enterprise Business Management Office, the DHS Office of Program Accountability and Risk Management, and OTC signed a memorandum of agreement regarding periodic program performance reporting. The purpose of this agreement was to set forth the terms by which these parties would work together to manage performance metrics reporting requirements to indicate if the program is adequately progressing along the approved cost, schedule, and performance baseline. This agreement set the expectation for

---

<sup>24</sup>In August 2014, the White House formally launched the U.S. Digital Service, a small team made up of digital talent that works with agencies to remove barriers to service delivery and help remake the digital experience that people and businesses have with their government. As part of this group's efforts, it created the *U.S. Digital Services* playbook. This playbook is a set of 13 key "plays" drawn from successful practices from the private sector and government that, if followed, should help government build effective electronic services.

<sup>25</sup>[GAO-12-681](#) and Software Engineering Institute, *Agile Metrics: Progress Monitoring of Agile Contractors*, CMU/SEI-2013-TN-029 (January 2014).

<sup>26</sup>A team's 'velocity' is defined as the total number of story points that the team can complete in a sprint. Velocity for each team can be measured and tracked over time, with the goal of having each team converge on a stable velocity.

monthly performance metrics to be submitted to the DHS Office of the CIO and Office of Program Accountability and Risk Management by OTC.

The metrics selected and those reported to DHS do not always provide a full picture of performance and could be improved. In our assessment of program metrics, we found no issues with metrics associated with external customer satisfaction and the quality of USCIS ELIS, but did identify concerns with the reliability, consistency, or applicability of other metrics, such as progress and scope.

### **Customer satisfaction**

In written responses, the Quality Assurance Team stated that the program measures the satisfaction of external customers. Specifically, the program management and evaluation division in OTC maintains a performance reporting dashboard. The Quality Assurance Team, in turn, monitors customer satisfaction metrics maintained on this dashboard. According to program officials, the Performance Management Division (now a branch under the Program and Resource Management Division) conducts the customer satisfaction survey once each month. The Chief of OTC noted that the customer satisfaction for external customers for the I-90 form was 93 percent. The Chief stated that, if it goes lower, the program would consider system changes. In addition to overall satisfaction, this survey also includes open-ended questions for tracking the aspects of the system that users like and other aspects that could be improved.<sup>27</sup>

However, the program does not measure internal user (e.g. adjudicator) satisfaction. Officials from the Quality Assurance Team stated that they monitor issues raised by adjudicators and adjudicator representatives during program reviews and retrospectives. Further, the Chief of the Capability Delivery Division stated that the operational test agent obtains internal user feedback on USCIS ELIS. However, the Chief of OTC explained that incident management (i.e. reporting of defects or issues by the field and service centers) and operational test agent reports have not

---

<sup>27</sup>We did not validate the process by which the program management and evaluation division collects and calculates customer satisfaction (i.e. reviews the hard data supporting this metric or reviews the individual surveys, question how customers are selected, etc.).



proven to be a useful tool for obtaining internal user feedback. As such, the Chief stated that OTC is developing a method for capturing internal user satisfaction. Program officials did not elaborate on the steps the program will take to collect internal user satisfaction or provide a time frame for collecting such metrics.

By not establishing metrics to obtain user feedback, the program limits its understanding of the value being delivered with each software release.

### **Code quality**

In written responses, the Quality Assurance Team reported that it calculates production defect/incident metrics, automated code scanning results, and code issue counts. In addition, the team collects code development metrics to gauge the quality of code delivered during a sprint. These metrics are included as part of the monthly status report and used for high-level planning.

In comparing the measurements associated with these metrics with our findings in the area of systems integration and testing, we did not identify any apparent concerns associated with these metrics. The results of measurements associated with these metrics identify underlying challenges the program is facing with product quality. For example, production metrics show that the rate in which issues (e.g. defects, incidents, bugs) are found exceeds the rate the issues can be closed. Such metrics may indicate a quality issue somewhere in the development process. However, the use of the metrics allows the program to identify such concerns and take steps to address them.

### **Progress**

In written responses, the Quality Assurance Team stated that it calculates progress and work completed. Specifically, the team calculates a burnup chart, contained within a cumulative flow diagram, that measures progress against the program's schedule goals. The program also tracks release burndown rates and other progress metrics. Such metrics are presented during oversight meetings, such as those before the Executive Steering Committee.

The release burndown charts and cumulative flow diagrams do not present a consistent picture of program progress. In particular, there are discrepancies between dates the program is working towards, as reported in the burnup or burndown charts, and the scheduled commitment dates

for a release. The program is also tracking progress by user story completion without accounting for the relative weight (i.e. complexity) of each user story. As such, burndown charts and cumulative flow diagrams do not provide an accurate picture of the program's progress over time. For example, the program reported to the Executive Steering Committee in October 2015 that they will complete 157 user stories to complete release 7.1 by February 2, 2016. However, without a perspective on the complexity of the user stories (i.e. story points), the number 157 lacks meaningful context.

The Chief of the Applied Technology Division of OIT confirmed that progress metrics do not account for the relative complexity of the work performed or of the work remaining. This official explained that it is a common practice to not incorporate relative complexity as, over time, there are enough stories of relative complexity that progress can be projected without accounting for complexity. OTC officials added that the completion date projected in progress metrics deviate from the dates committed to during release planning because a release plan is only an estimate and can change depending on business priorities. Officials added that the system can theoretically be deployed at any time; however, OTC might sometimes determine that additional functionality should be incorporated before the release is made available to the public.

However, even if the complexity of all user stories for release 7.1 is consistent, presented timelines still do not reflect realistic end dates based on past trends. For example, the burndown chart for release 7.1, presented to the Executive Steering Committee in October 2015, reported program completion of 2 user stories in the first 2-week period, 11 user stories in the next 3-week period, 7 user stories in the next 1-week period, and 14 user stories in the next 4-week period. At this rate, the program would complete 34 user stories every 10 weeks. Accordingly, the program should expect to complete an additional 63 user stories by February 2, 2016, leaving 94 user stories undeveloped at deployment. However, the chart presented to the committee shows that all user stories will be completed by the scheduled goal of February 2, 2016, thus delivering all planned functionality and features.

Without reliable metrics by which to track progress over time, the program may present to stakeholders an unrealistic picture of the value they expect to deliver by a particular date.

## Velocity

USCIS policy, guidance, and underlying team process agreements all recognize velocity as a valuable metric for measuring progress and identifying areas for improvement. Velocity is defined as the total number of story points that the team can complete in an individual sprint. The goal is to have each development team converge on a stable velocity to allow a more realistic projection of future work capacity to assist commitments made by the team in planning for a sprint.

Our calculations of team velocity over time show no evidence of teams reaching a point of stable development output. Based on our calculations of team velocity across 29 sprints (some teams were captured across fewer sprints due to the nature of when they began work on USCIS ELIS), team velocity was erratic from sprint to sprint. For example, based on these metrics, the velocity for one development team was 26, 13, 2, 8, 8, and 26 across sprints 52 to 57, respectively. Similarly, the velocity for another development team was 24, 45, 16, 32, 23, and 23 across the same sprints.

In addition, development teams are not always using velocity measures to inform their planning commitments. In particular, development teams are consistently overcommitting to work they will complete within a given sprint. Specifically, based on our analysis, between sprints 35 and 63, the 12 development teams working on USCIS ELIS collectively overcommitted at sprint planning 47% of the time based on the prior sprint velocity. The teams also accepted additional work during sprints (i.e. accepted additional user stories following the first day of a sprint), thus overcommitting 66% of the time by the end of the sprint.

Our findings are reinforced by the finding of the Quality Assurance Team. In consolidated release assessments, the Quality Assurance Team reported that, between sprints 47 and 62, all planned work items were not delivered by development teams in 68 percent of the sprints (47 of 69 responses).

The Chief of OTC stated that velocity has routinely been in a state of flux from year to year but that such fluctuations are expected because the development teams are relatively new. The Chief explained that development teams operating under the old contract achieved a stable velocity but, in transitioning to the new contract, velocity again became unstable. Nevertheless, a team should be able to begin achieving a more stable velocity within a few sprints, and development teams had sufficient

time to achieve a stable velocity by the time the preceding measurements were taken.

Erratic team velocity means that the program will have difficulty accurately anticipating how much work development teams can complete in each sprint, thus limiting the program's ability to accurately anticipate the amount of work that can realistically be completed in a given development period.

### **Program schedule goals**

One of the metrics the program agreed to report to DHS on a monthly basis was an integrated master schedule to monitor program status and evaluate execution of the schedule.

The program has established a general programmatic goal for schedule that is reflected in the approved acquisition program baseline and underlying life cycle cost estimate. Furthermore, USCIS Agile software development policy requires deployment of functionality, as approved in a release readiness review, at least quarterly with the expectation that each release should not exceed six months.

Based on our review of the development period for each major (e.g. product line) release (the period between release planning and release readiness review approval), releases have exceeded the projected schedule defined in the life cycle cost estimate. Furthermore, there were no releases completed within a six-month period.<sup>28</sup> Table 8 reflects the planned versus actual start and end dates for each major release along with the total period of development.

---

<sup>28</sup>In written comments, the USCIS CIO stated that the program is meeting the goal of delivering software every 6 months. He stated that the program deploys minor releases, such as enhancements, or fixes, to existing functionality, on a weekly basis. As such, in his estimation, the program is meeting the schedule goal articulated in USCIS Agile development policy. The *USCIS Agile Development Policy* does not differentiate between a major and minor release.

**Table 8: Planned versus Actual Release Cycles for Major Program Releases, as of April 2016**

Release number	Planned release start date	Planned release end date	Release planning review approval date	Release readiness review approval date	Total development period	Schedule delay (approximation)
5.0	5/29/13	2/21/15	5/28/2013	2/20/2015 <sup>a</sup>	21 months	0 months
5.1	2/27/13	4/25/15	11/5/13	8/27/2015	21 months	4 months
6.1	3/4/15	8/15/15	4/7/15	2/1/16 <sup>b</sup>	10 months	5 months
6.2	3/4/15	8/15/15	4/7/15	Not yet achieved	12+ months	7+ months
7.1	6/24/15	12/5/15	7/30/15	4/13/16	9 months	4 months

Source: GAO analysis of USCIS documentation. | GAO-16-467.

<sup>a</sup>I-90 functionality was made available in November 2014 in a limited 72-hour release (release 5.0.0). Full deployment of this functionality did not occur until February 2015 (release 5.0.1). Lockbox functionality was deployed for processing the I-90 after February 2015 (release 5.0.2).

<sup>b</sup>Deferred Action for Childhood Arrivals functionality was made available in October 2015 but was limited to only one Lockbox facility for the processing of applications submitted on one day. According to the program, the Phoenix Lockbox facility began receiving cases on a regular basis beginning in January 2015. All other Lockbox facilities began receiving applications in February 2015.

The program is reporting updated schedule dates as part of the monthly performance assessment. These dates reflect changes in the program schedule and the impact of schedule delays. Based on the reported schedule, the program appears to project only a 3-month delay from the initial schedule, which is within the program schedule threshold of March 2019. However, as we have seen with releases to date, the schedule figures are not always presenting the full picture. For example, the schedule indicates an end date of November 2015 for release 6.1; however, the actual end date was February 2016. According to the program management review from February 2016 and our discussion of this date with the program office, Deferred Action for Childhood Arrivals cases were not fully being processed until February 1, 2016.

According to officials from OTC, there are a number of reasons for deviation from schedule. The Chief of OTC stated that their goal is to always deliver code but that they do not always make it available to internal users (i.e. go live). The Chief explained that the code base should always be ready for deployment. However, actual deployment may take longer based on the needs of the business. In addition, the deployment date flexes based on discussions with leadership. For example, the estimates for release 7.1 deployment were a best guess as of 2015. However, additional information regarding the release came to light following release planning and, consequently, the deployment date shifted.

These delays increase the risk that the program will proceed with development or deployment in the future earlier than it might be ready in order to meet the committed dates. The program is also at risk of future schedule delays in subsequent releases, which might result in the program exceeding its established threshold.

### **Program cost goals**

In addition to monitoring program schedule, the program agreed to report on obligations and expenditures monthly and use burn down analysis to monitor program costs against the life cycle cost estimate for the fiscal year.

The program established a cost goal that is defined in the approved acquisition program baseline and is based on an underlying life cycle cost estimate. According to this estimate, the program has established a cost objective of approximately \$2.9 billion and a cost threshold of approximately \$3.1 billion. The largest cost in this estimate is associated with release development, with a cost projection of approximately \$187.6 million. The program set an assumption that 12 development teams would work on each release. It then projected the cost of each development team against the period of development to arrive at the projected cost of development for that release. These projected costs help the USCIS CIO to determine, during release planning, whether the cost is justified by the capabilities to be delivered.

As noted in the previous table on schedule, the program is not meeting the projected start and end dates reflected in the cost estimate. For example, the cost estimate projected development costs for 6.0, subsequently broken out by the program into releases 6.1 and 6.2, through June 2015. However, the program did not fully deploy release 6.1 until February 2016 and did not project to complete development of release 6.2 until May 2016. As a result, development of future releases was delayed. For example, the program just completed planning for release 8.0 in February 2016 although it was estimated for November 2015. The program has also not yet finalized planning for release 9.0, which was scheduled to take place by February 2016.

Moreover, the program has not accounted for some additional contracts awarded since the cost estimate was updated. For example, the approved acquisition plan for the program does not include a contract for Agile engineering and test automation services, which carries a cost of over \$12 million.

Although we found the life cycle cost estimate to be generally reliable, and the program is clearly reporting against this estimate, the lack of an update to the estimate means that performance may be tracked against a baseline that is no longer relevant.

**Program scope**

In addition to monitoring program schedule and cost, the program agreed to report on the percentage of sub-features completed versus the percentage of sub-features planned, broken down by major release.

The program reports the scope of each release in the form of sub-features to be delivered within each release. In reporting to management, the program identifies the planned number of sub-features to be developed in each release and updates this number to reflect the actual number of sub-features developed. For example, in October 2015, the program explicitly identified the sub-features developed for release 6.1. Table 9 lists the most recent number of sub-features planned for near-term releases relative to the number actually delivered.

**Table 9: Transformation Program Sub-Features Delivered by Near-Term Releases, as reported to DHS in February 2016**

Release number	Planned number of sub-features	Actual number of sub-features	Cumulative number of sub-features implemented
5.0	130	126	126 of 235 <sup>a</sup>
5.1	10	10	136 of 235
6.1	13	9	145 of 235
6.2	1	Not yet achieved	Not yet achieved
7.0	28	Not yet reported	Not yet reported
8.0	3	Not yet achieved	Not yet achieved

Source: GAO analysis of USCIS documentation. | GAO-16-467.

<sup>a</sup>The Transformation Program will not achieve full operating capability until release 16 has been completed. On achieving full operating capability, the program plans to deliver a total of 235 sub-features that, collectively, make up the full functionality of the program. This table only represents near-term releases and excludes sub-features planned for future releases (i.e. release 15.0). The program has increased the number of planned sub-features to 235, which has impacted reporting on the number of planned versus actually delivered sub-features.

Based on our review of the backlogs for releases 6.1, 6.2, and 7.1 (the program subsequently renamed release 7.0 as release 7.1), the program has not fully documented if it is delivering the sub-features it has intended to deliver in each release. The most recent backlogs provided to us in March 2016 include a field termed “traceability.” This field maps a user

story back to a supporting sub-feature and/or feature. According to this field:

- 6 of the 9 sub-features were not developed or were not clearly traceable to the backlog for release 6.1;
- The one sub-feature associated with release 6.2 either was not developed or was not clearly traceable to the backlog; and,
- 19 of the 28 sub-features were not developed or were not clearly traceable to the backlog for release 7.1.

In a written response, the Business Integration Division within OTC, which is responsible for defining the initial release backlog committed to in release planning, recognized issues in traceability of user stories to sub-features. This division stated that the process that was used to verify the number of sub-features implemented against planned was based on verbal confirmation from the product owner. The division subsequently determined that this process was not effective since it relied solely on the review of the user stories and was not as exact and reliable as expected. As a result, the division stated that there could be sub-features that were reported as implemented by the product owner but that would not show any associated user stories because they were not directly mapped to the sub-feature in the software management tool.

To address this challenge, the Business Integration Division reported working in collaboration with the Capability Delivery Division of OTC to develop a process to manage and track requirements of USCIS ELIS at sub-feature level throughout the development life cycle. All requirements for each new release are now to be reviewed and concurred with by the appropriate product owner at the sub-feature level. This concurrence should take place after collaborating with the end users and subject matter experts. The requirements are then to be converted into user stories and entered into the new software tool, where their traceability to the approved set of sub-features is established by following the predefined hierarchy and tracked throughout the development process. The division noted that requirements traceability is critical to avoid scope creep and to demonstrate that the user stories implemented addressed the mission needs. However, as noted, the most recent release backlogs provided to us, which include this traceability between user story and sub-feature, still do not reconcile the gaps in reporting.

Of additional concern is the ongoing development of sub-features in subsequent releases. The program road map and monthly performance



reports imply that sub-features are fully developed within each release, but many sub-features require additional work in subsequent releases. For example, sub-feature 2.4.1.1 'Provide Case Summary Information for Review' was developed as part of release 5.0.1, the soft launch of the I-90. Program projections show development work of this same sub-feature for all subsequent releases, 5.1 through 16. For example, the backlog for release 7.1 indicates that 37 user stories were developed in support of this already existing sub-feature.

The lack of traceability between scope metrics reported by the program and the release backlogs indicates a level of unreliability in reporting on scope. Moreover, the continual need for additional effort after delivery of a sub-feature raises additional concerns regarding the extent to which the program has effectively forecasted future work in its cost and schedule projections.

---

# Appendix III: Management of Systems Integration and Testing for USCIS ELIS

---

This appendix describes in more detail our evaluation of the three key practices for systems integration and testing. It does not present new findings. Rather, the information detailed in this appendix is intended to assist USCIS in implementing the recommendations described in our report.

Establishing an environment and procedures for continuous integration and testing of code

Program planning documentation<sup>1</sup> calls for establishing an environment for continuous integration<sup>2</sup> and testing<sup>3</sup> that includes the following tools and practices.

- Configuration management: Identifying and documenting characteristics of the software code at specific points in time.
- Daily code integration: Integrating developer's code with the main code base daily.
- Daily automated code builds: Daily compiling and testing of code that is to lead to an operational version of a system.
- Automated tests: Providing timely feedback on the development process through the use of small automated tests to establish a solid foundation for subsequent testing.
- Failing tests stop the build: Stopping the progression of code through the development pipeline if newly developed code is defective, as indicated by failing tests at any stage of the development process.
- Rapid feedback: Providing rapid feedback to the development teams to allow them to resolve defects prior to completing a given development iteration.

USCIS has established an environment for continuous integration and testing for USCIS ELIS. For example, the program has created a process

---

<sup>1</sup>See, for example, USCIS ELIS *Team Process Agreements*, *Transformation Program Test and Evaluation Master Plan*, and *Transformation Program Test Plans*.

<sup>2</sup>Continuous integration is a practice of frequently merging an individual piece of software code with the main code repository, so new changes are tested continuously.

<sup>3</sup>Continuous testing is a practice of testing software code throughout the sprint and providing feedback to the developers so that they can address issues and develop software that meets all required quality criteria. Using this approach, code is tested in various environments, from the development environment to a production-like environment.

for the automated build of software code and automated testing of that code during the build process. Table 10 describes in more detail the continuous integration and testing tools and practices in support of USCIS ELIS.

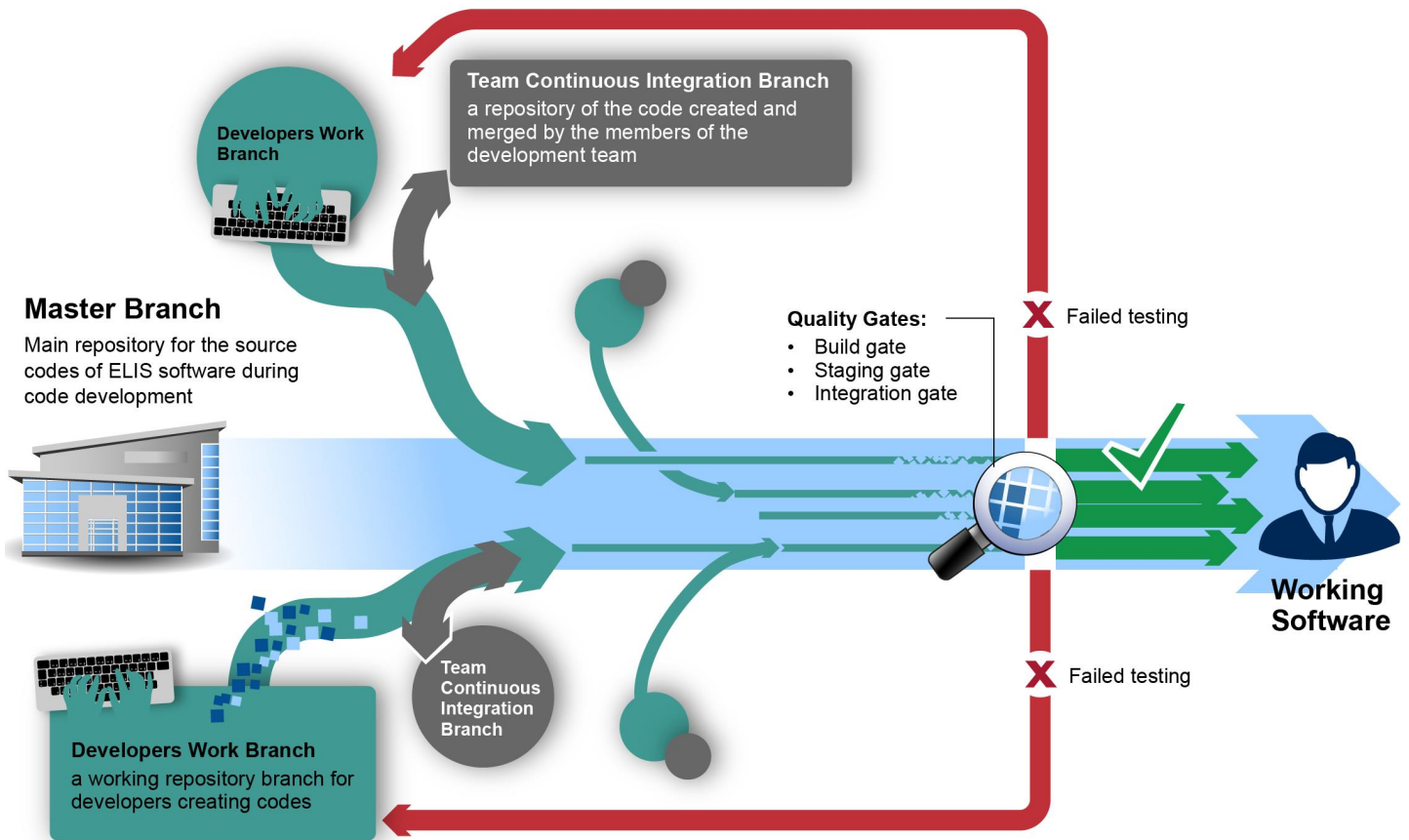
**Table 10: Summary of Management of Continuous Integration and Testing Tools and Practices**

Practice or Tool	Rating	Description
Configuration management	yes	USCIS ELIS code is placed under configuration management.
Daily code integration	yes	USCIS established conditions that allow for daily code integration.
Automated code builds	yes	Continuous integration server and other tools allow for automated code builds.
Automated tests	yes	USCIS established conditions for automated tests to be written and executed by developers.
Code build stops with test failure	yes	USCIS implemented a process that can halt progress of defective code.
Rapid feedback	yes	Feedback from the automated tools can be provided to developers and program management instantaneously.

Source: GAO analysis of USCIS documentation | GAO-16-467.

The build process starts with a separate work branch in which code is written and tested by a developer on a local machine. When ready, the developer submits a request to merge and integrate the code with other code produced by the development team. This branch is referred to as the team continuous integration branch. If the merge is successful, this code is then compiled and must pass through a series of three gates: build, staging, and integration. As part of each build, a suite of automated tests are performed. If the build is successful, the software governing the build process will merge the code into the master code base. According to the senior continuous integration technical lead, the build process typically takes about an hour. Figure 9 provides a high-level overview of the continuous integration process followed as code is developed and submitted.

Figure 9: Continuous Integration Build Process for USCIS ELIS



Source: GAO analysis of U.S. Citizenship and Immigration Services documentation. | GAO-16-467

Performing continuous testing through the use of unit and integration tests, functional acceptance tests, and code inspection

In order to effectively test code, a program should perform continuous testing at different stages of development. These tests are to include, among other things, unit and integration tests, functional acceptance tests, and code inspection.

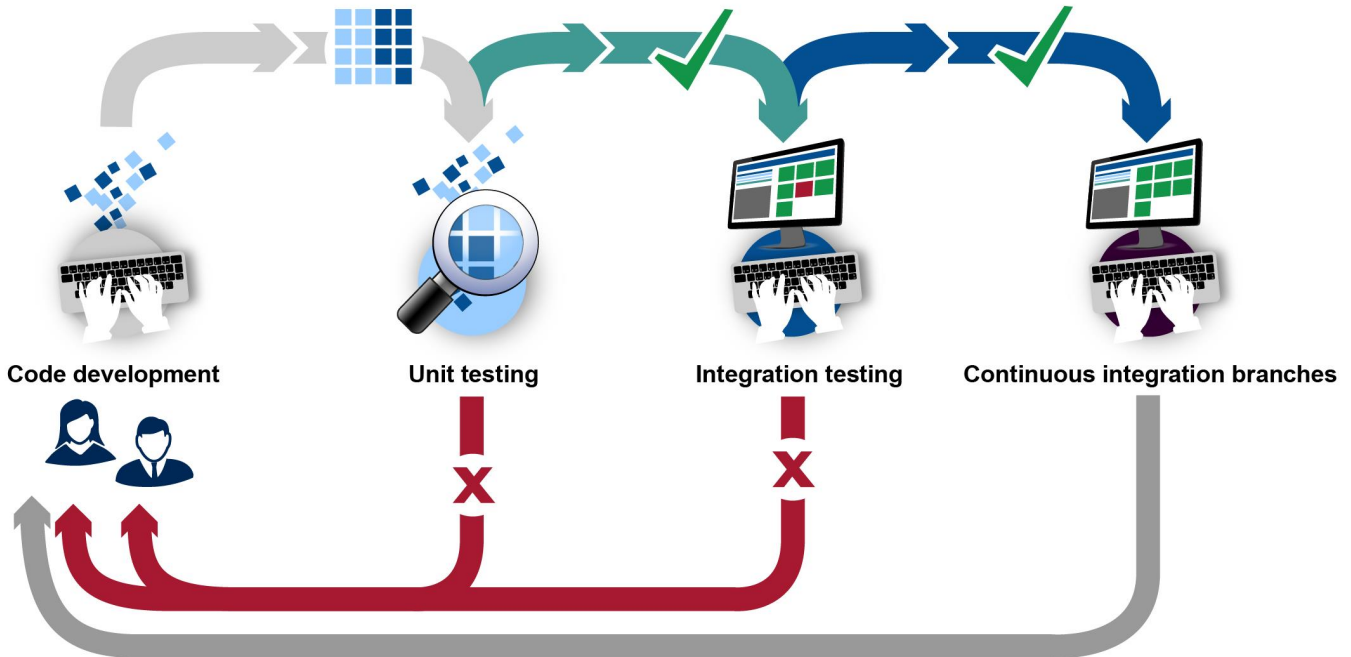
### Unit and integration testing

According to the program's Test and Evaluation Master Plan,<sup>4</sup> two tests are to occur on new code written by developers: unit and integration tests. Unit tests are small, automated tests used to verify that each individual unit of code written by the developer works as intended. Integration tests are intended to verify that individual modules or components function together as expected when combined. USCIS policy states that both unit and integration tests are to cover all developed code; that is, reach 100 percent code coverage. See figure 10 for a high-level overview of how unit and integration tests fit in a developer's process for developing and building code.

---

<sup>4</sup>USCIS Transformation Program, *Test and Evaluation Master Plan, Electronic Immigration System, version 1.0* (Mar. 10, 2015). The *Test and Evaluation Master Plan* outlines the overall test and evaluation strategy for the USCIS Electronic Immigration System. This document was updated and approved as part of the program re-baseline in 2015.

Figure 10: Unit and Integration Testing Process



Source: GAO analysis of U.S. Citizenship and Immigration Services documentation. | GAO-16-467

The program's team process agreements for releases 6.1 and 6.2 state that unit and integration testing is also a requirement for accepting individual pieces of software as complete. In addition, according to our standards for internal control,<sup>5</sup> managers are to

- promptly evaluate findings from audits and other reviews, including those showing deficiencies and recommendations reported by auditors and others who evaluate agencies' operations,
- determine proper actions in response to findings and recommendations from audits and reviews, and

<sup>5</sup>GAO, *Standards for Internal Control in the Federal Government*, GAO/AIMD-00-21.3.1 (Washington, D.C.: Nov. 1999).

- complete, within established time frames, all actions that correct or otherwise resolve the matters brought to management's attention.

The program has exhibited improvement in unit code coverage since 2015, but none of the internal applications that collectively make up USCIS ELIS have achieved the stated goal of 100 percent code coverage. For example, based on system-generated output of unit code coverage provided by the program, the largest application that makes up USCIS ELIS, ELIS2Services, achieved 49.8 percent unit code coverage as of August 2015. In March 2016, unit test code coverage of the same application improved to 64.2 percent. However, while 64.2 percent is an improvement, it still does not meet the original goal of the program. The Quality Assurance Team continued to report on this issue in April, May, June, and November 2015, citing 17 new tickets opened for having no or poor unit test coverage.

In addition, the program did not provide evidence of integration code coverage. The Quality Assurance Team reported in May 2015 that integration testing, among other tests, is not occurring with any degree of regularity. However, the team added that the testers do not publish their test results, so it is not possible to know whether testing is taking place or whether anything is being done with the results to improve the process. As integration tests are not documented, the program was unable to provide evidence of the extent of the code covered by integration tests.

Unit and integration testing does not meet USCIS standards due to a lack of internal controls over ensuring standards are met. The product owner for releases 6.1 and 6.2 stated that they assume that unit and integration testing are complete and that tests meet USCIS standards prior to demonstrating a user story for acceptance. The product owner requires a test summary report for each story that demonstrates acceptance criteria are properly met, but does not require validation that other testing required by the developer took place. Moreover, the *ELIS Test Plan*, updated in July 2015, refers to integration tests as useful, but does not explicitly require them to be written. This is in contrast to the prior version of the plan covering development period from October 15, 2014, to April 15, 2015, which stated that integration tests should be written before the code is written. The test plan also conflicts with the commitment made with DHS for integration testing as articulated in the Test and Evaluation Master Plan.

To improve on the coverage of unit tests, the Senior Continuous Integration Technical Lead stated that any new build must meet the

existing threshold for code coverage. For example, if the current unit test code coverage for the ELIS2Services application is 63.7 percent, then any new code submitted for this application must contain at least 63.7 percent unit test coverage. This official explained that using the latest code coverage value of a passing build was always a rule for establishing threshold value for unit test coverage and helps to ensure a consistent increase in overall coverage over time.

In the documentation received from the program on March 17, 2016, the historical progression of code coverage indicates that the coverage trend is not consistently increasing as suggested by the technical lead. For example, coverage for InternalApp was 53.5 percent on January 13, 2016, but it decreased to 52.3 percent on March 15, 2016. Similarly, InternalAppDomain decreased by 6.7 percent in the same period. In total, agency reports show that internal application code coverage ranged from 31.2 percent to 96.9 percent. According to the USCIS CIO, the goal of 100 percent code coverage is unrealistic. We agree with this opinion; however, this is the goal stated and committed to in the program Test and Evaluation Master Plan.

The Quality Assurance Team has cited inadequate testing as the primary cause for issues encountered in production. More concerning is that issues in testing and the quality of software code were issues previously raised in development of legacy USCIS ELIS.

### **Functional acceptance testing**

The Transformation Program uses functional acceptance tests to verify that all user story acceptance criteria have been met. The Test and Evaluation Master Plan for the program states that functional acceptance test scenarios should be executed as capabilities are added or updated. The program also documented procedures for performing these tests.

The program did not provide evidence that functional acceptance tests were being performed for all user stories as required. In November 2015, we requested functional acceptance test scripts and results for a random sample of 80 user stories associated with USCIS ELIS releases 6.1 and 6.2. Of these 80 user stories, only 74 were considered complete and therefore would have undergone functional acceptance testing. In response, the program provided evidence indicating that functional acceptance tests had occurred, and passed, for 11 of these 74 user stories. Based on the descriptions of the remaining 63 user stories, we expect that a subset of these would also require functional acceptance



tests. However, the program did not provide evidence that the testing had been performed.

Program officials attributed the lack of evidence for functional acceptance testing to its transition to a new software tool. Nevertheless, our review of testing documentation shows that this transition does not fully account for the missing test documentation. Specifically, according to officials in the program office, the program transitioned to a new software tool for user story management in September 2015. However, not all the information was properly migrated from the old system, including some attachments containing information on user stories that was evidence to support whether tests had been performed. Based on our observations, this would have affected 64 of the 80 user stories that we examined. Of the 16 that were not migrated, and instead were defined using the new software tool, 6 did not include evidence of acceptance tests having been performed. The program provided subsequent evidence that 2 of these 6 user stories were 'resolved' into 8 other user stories for which the program provided no additional testing information. For another user story, the program provided an extract that indicated existence of a testing document but the program did not provide the actual test document. The program office was unable to explain the lack of acceptance tests for the other user stories.

Further, monthly status reports from the Quality Assurance Team support our findings and raise questions about the extent to which functional acceptance testing is occurring. For example, in June 2015, the Quality Assurance Team noted that functional testing is not occurring with any degree of regularity. Quality assurance team reports have not provided updates on functional acceptance testing since June 2015.

Without assurance that acceptance tests are being performed for each user story prior to acceptance by the product owner, USCIS cannot ensure that the user stories meet the needs of USCIS as defined in associated acceptance criteria.

## Code Inspection

Code inspection is the process of inspecting code automatically and manually<sup>6</sup> and comparing it to internal coding guidelines. The team process agreements for releases 6.1 and 6.2 calls for all software code to undergo inspection before it is accepted as complete. According to industry leading practices,<sup>7</sup> automatic and/or manual inspection should be performed to provide additional assurance of software quality.

In addition, the program has established a mechanism for automated code inspection and, in January 2016, the program provided documentation indicating its current results. Moreover, the tool that the program uses to conduct automated code inspection can notify developers when code does not meet coding standards.

The program has also implemented two types of manual code review. According to program officials, the Quality Assurance Team performs focused reviews of high risk code in order to focus on critical aspects of the software. Officials explained that the team is not large enough to review the entire code base and must instead focus their efforts on the areas that will be of the greatest impact. In addition to a review by the Quality Assurance Team, in April 2015, the program instituted a peer review process for manual review of all code.

The program provided evidence that Quality Assurance Team reviews are taking place. In March 2016, the program provided data on a review of code submitted in merge requests, along with the number of tickets opened based on that review, for the period from September 2015 through March 2016. Based on this spreadsheet, 577 tickets were opened to address issues found during code review by the Quality Assurance Team. However, the program did not provide evidence that the peer review process is being performed and documented consistently. According to internal guidance available to developers, a request to merge code with other developers is submitted as part of continuous

---

<sup>6</sup>Continuous testing is generally considered to be automated testing. However, this report addresses code inspection under the broader heading of continuous testing, even though code inspection includes both automated and manual inspection.

<sup>7</sup>IEEE, *IEEE Standard 29119-1*.

integration. Before this request is approved, a technical assignee should perform the peer code review and document acceptance in the software tool. Based on a walk-through of the software tool in which the peer review process is documented, we found that peer review took place for 40 out of 53 of the 80 user stories we reviewed for which it was applicable, and did not take place for the remaining 13 of these user stories.

Some stories were excluded from these calculations because:

- Development and merging of the code for those user stories took place prior to June 2015, when the peer review process was initiated.
- A merge request was made but was closed rather than accepting the merge (we did not pursue the rationale for closure).
- The user story did not result in any code being developed and pushed to master (i.e. more an administrative task than actual functionality being built).
- The user story was still “defined,” meaning a team had not yet started developing it, and not “accepted,” meaning the product owner did not approve the story upon completion of development.

In addition, of the 13 user stories for which we could not confirm documented acceptance, some user stories may have been submitted as part of another merge request (i.e. user story 1234 was coupled with user story 1235 and submitted as user story 1235 merge request). However, we could not determine in which instances this was a cause for a gap in peer review.

Until the program establishes a mechanism to validate that the peer review process takes place, the program cannot be assured that user stories are adhering to program coding standards, which may result in poor code quality.

Developing complete test plans and cases for interoperability and end user testing and documenting those results

### **Interoperability testing**

Interoperability testing is an independent test in a production-like environment that is intended to verify the capability of system components and external work flows, communication, and information

sharing in a controlled condition. The program's Test and Evaluation Master Plan requires execution of interoperability tests following any change to a system that interfaces with USCIS ELIS. In addition, leading practices<sup>8</sup> detail the activities required for documenting test planning, execution, and results reporting. We evaluated USCIS ELIS interoperability and end user tests against these practices.

USCIS demonstrated that it has developed test plans, cases, and documented results for compatibility testing. The lead tester from the Interoperability Test Team stated that his team may test the parameters of a public facing system such as end-user parameters of different browsers and operating systems using a non-DHS network connection. This official added that the Interoperability Test Team is concerned with whether the system meets certain technical parameters related to operating systems and different types of browsers interacting with USCIS ELIS.

However, compatibility tests do not meet the intent of interoperability testing as defined by the Test and Evaluation Master Plan. The test plans and associated cases and results provided by the program document the ability of USCIS ELIS to execute using specific browsers and operating systems that mirror the USCIS environment. This type of testing ensures that a system is compatible with existing software and will work within a physical operating environment. This type of testing does not test the ability of USCIS ELIS to communicate and share information with other systems, either within or outside USCIS. Instead, program officials noted that interoperability, as defined in the program's Test and Evaluation Master Plan, is to be tested through live interface testing.

USCIS has not developed tests plans or cases for live interface testing. The USCIS Test and Evaluation Master Plan states that live interface testing is to be performed with all internal USCIS and DHS systems before new functionality is promoted to the production environment. Program officials stated that there is no live interface test plan or associated test cases. Instead, the program documents test charters, which include a mission statement and conditions for successful operation of all product lines. However, the test charters provided by the

---

<sup>8</sup>IEEE, *IEEE Standard 29119-3*.

program do not meet the requirements for a test plan or test cases. In particular, they do not identify the test items, scope, risks, or other elements of a test plan.

The program has documented some results for live interface testing. USCIS officials stated that test results are documented in associated tester notes rather than in test completion summary reports. Although testing documentation can be tailored on Agile projects, live interface session testing results are notes from the testing session and are not projectable to the entire scope of releases 6.1 and 6.2. In particular, those notes cover eight sessions from October 13 to December 28, 2015, and these notes do not meet the requirements for documenting test results for interoperability testing, such as details on what was tested and whether the test met the specified completion criteria.

According to the Chief of the Delivery Assurance Branch, development teams do not produce a detailed test plan and report because unit tests should be documented in source code and most of the functional tests should be documented in scripts. According to this official, results from these tests should be documented in the continuous integration build tool used by the program and all tests should tie to a user story. Accordingly, a program manager for the Independent Test and Integration division stated that documentation associated with a test plan, case, or results is addressed in development of individual user stories. For example, if a user story requires interfacing with the Lockbox, then acceptance criteria for that story would define the parameters or preconditions for testing the user story with the Lockbox. However, independent testing of user stories does not address the need for a plan, cases, or results that reflect the ability of USCIS ELIS to interface with other systems internal and external to USCIS.

In not documenting that testing occurs and the results of this testing, the program may be producing a system that cannot effectively exchange important information and use the information being exchanged in processing immigration applications. This is particularly important due to the number of systems with which USCIS communicates. See appendix IV for a list of systems with which USCIS ELIS must communicate.

Without a test plan and documented cases and results demonstrating execution of that plan for interoperability testing, USCIS cannot ensure that the performance between USCIS ELIS and other systems on which it depends is consistent and successful.

## End user testing

End user testing is conducted to verify that business value is delivered and user story acceptance criteria are met. The *USCIS ELIS End User Test Strategic Plan* describes end user testing as involving USCIS ELIS users to test functionalities and usability using real-world scenarios prior to implementing a release into production. Leading practices<sup>9</sup> require that for tests such as end user tests, the program should establish test plans, test cases, and test completion reports that address certain practices. Specifically,

- Test plans should be uniquely identified, document test items, include the scope, strategy, activities, and schedule for testing, and discuss risks surrounding the test.
- Test cases should also be uniquely identified, trace back to associated requirements, describe the conditions around which the test occurs (i.e. environment), and define test inputs and expected results.
- Test completion reports should be uniquely identified, summarize the testing performed and any deviation from planned testing, evaluate the extent to which test criteria were met or not, identify factors that blocked progress, present any collected measures, residual risks, and lessons learned, and document any test deliverables produced in support of the testing effort.

The program did not provide evidence of having developed test plans, cases, or test completion reports between March 2015 and June 2015.

After this period of development, the program provided an end user test plan that met most of the leading practices. In June 2015, the program transitioned responsibility for end user testing to a new contractor. The plan for end user testing provided by this new contractor defined the test items, scope, schedule, and the general type of test performed. The only element that the plan did not address is identifying test completion criteria as part of the larger test strategy. Table 11 provides additional details about the extent to which the *USCIS ELIS End User Test Strategic Plan* meets leading practices.

---

<sup>9</sup>IEEE, *IEEE Standard 29119-3*.

**Table 11: USCIS ELIS End User Test Plan Evaluation**

<b>Criteria element</b>	<b>Rating</b>	<b>Description</b>
The plan identifies project or test type for which the plan is being written.	Yes	The plan identifies the project and test type.
The plan includes a unique identifier	Yes	The document can be uniquely identified.
Test items identify the objects of testing, for example a system or a software item.	Yes	The plan identifies the object of testing.
Test scope summarizes the features of the test items to be tested and identifies any features that are excluded from the test and the reason for such exclusion.	Yes	The document indicates that end user testing sessions will be focused on new product functionality.
Risk register identifies test-related project and product risk as well as risk mitigation approaches.	Yes	The document includes test-related risks.
Test strategy:	Not applicable	Not applicable
Identifies the particular test to be performed (such as integration, interoperability)	Yes	The document identifies the tests to be performed.
Identifies documentation to be produced at the conclusion of the test	Yes	The document identifies documentation to be produced at the conclusion of the test.
Specifies which test design techniques are to be applied	Yes	The document indicates that a scenario testing approach is used as a test design technique
Identifies test completion criteria	No	The plan does not identify the test completion criteria.
Identifies what metrics should be collected during the test activities	Yes	The document identified metrics that should be collected.
Specifies all relevant test data requirements	N/A	In the written responses, the program indicated that data for test scenarios is based on acceptance criteria. Since data requirements may vary between user stories, the test plan does not specify the relevant data requirements.
Specifies the necessary and desired properties of the test environment	Yes	The plan specified that end user testing occurs in end user testing environment and the plan includes a description of the test environment.
Testing activities are based on the test process to be used and include an activity iteration strategy for test re-execution as well as any dependencies	Yes	Testing activities are documented in the plan. Test activities show the dependencies and indicate the session in which the End User Test Team will troubleshoot tester problems.
Testing schedule identifies test milestones defined in the project schedule and summarizes the overall schedule of the testing activities.	Yes	The plan states that end user testing sessions will occur on a weekly basis.

Source: GAO analysis of USCIS ELIS High Level End User Test Plan | GAO-16-467.

The program also provided test cases that addressed most of the leading practices. Specifically, we reviewed all test cases used in sessions from June 2015 to September 2015. These end user test cases specified expected test results and associated inputs. However, some of the cases did not describe preconditions for the test. Table 12 provides additional

details about the extent to which end user test cases met leading practices.

**Table 12: USCIS ELIS End User Test Case Evaluation**

Criteria Element	Rating	Description
Unique Identifier to distinguish the test case from all other test cases. The unique identifier is not to be changed during the lifetime of the test case item, because it is used for traceability purposes.	Yes	The 19 test cases were uniquely identified.
Traceability links the test case to the test coverage item or provides reference to the associated requirements.	Yes	The program documented traceability between user stories and end user test sessions.
Preconditions describe the required state of the testing environment and any special conditions related to the execution of the test case.	Partial	Three test cases do not include preconditions.
Inputs specify each action required to bring the test item into a state where the expected result can be compared to the actual results. The detail of the description should be tailored to fit the knowledge of the testers. All required relationships between input events must be described.	Yes	All test cases specified actions required to bring the test item into a state where expected results can be compared with the actual results.
Expected results specify the expected output and behavior required of the test item in response to the inputs that are given to the test item when it is in its precondition state.	Yes	With the exception of exploratory cases, test cases specified expected output and behavior of the system under test.

Source: GAO analysis of USCIS ELIS end user test cases | GAO-16-467.

The program also provided test summary results from June 2015 to January 2016 that met some of the leading practices. For example, test completion reports summarized the testing performed, test measures, and highlighted some lessons learned. However, these reports did not identify residual risks, report all of the factors that blocked progress, or define deliverables produced as a result of testing. Table 13 provides additional details about the extent to which end user test completion reports met leading practices.

**Table 13: USCIS ELIS End User Test Summary Results Evaluation**

Criteria element	Rating	Description
Documents are uniquely identified.	Yes	All documents are uniquely identified.
Summary of testing performed provides details on what was tested and any testing constraints.	Yes	All test completion reports contain summary of testing performed.



**Appendix III: Management of Systems  
Integration and Testing for USCIS ELIS**

<b>Criteria element</b>	<b>Rating</b>	<b>Description</b>
Description of deviations from the planned testing, if any.	Partial	Test completion reports do not include information on deviations from the planned testing or indicate if such deviations existed. However, even though the test completion report does not include information on the deviation of the planned testing, a vehicle exists to capture and address such deviations. This is a tailored solution which is consistent with the Agile approach and uses existing Agile project management tools.
Test completion evaluation includes information to what extent testing met the specified test completion criteria and explains why the criteria were not met where appropriate.	No	None of the test completion reports include evaluations of test completion.
Identifies factors that blocked progress and corresponding solutions used to remove them.	Partial	Test completion reports did not include information on factors that blocked progress. However, USCIS provided a record of six impediments between June 22, 2015, and August 18, 2015, and six tickets created between June 23, 2015, and September 13, 2015, that documented issues encountered during testing.
Test measures present the collected test measures that could include test cases, defects, incidents, test coverage.	Yes	All test completion reports included test measures.
Residual risks are the risks that are untreated at the end of the testing. This may be risks that have not been fully treated by the test or new risks.	No	Test completion reports do not discuss risks.
Test deliverables are produced as a result of the testing effort and their location.	No	Test completion reports do not include information on test deliverables and their location.
Lessons learned	Partial	Three out of 14 test completion reports did not contain lessons learned.

Source: GAO analysis of USCIS ELIS End User Test Summary Reports | GAO-16-467.

# Appendix IV: USCIS ELIS Interfaces

The goal of the Transformation Program is to link developed systems, enterprise services, and existing systems and capabilities to enable end-to-end processing. The central project in this portfolio is the USCIS Electronic Immigration System (USCIS ELIS), which is to enable electronic filing and adjudicative case management as a component of a larger architecture consisting of multiple systems, services, and interfaces. In particular, according to officials, USCIS ELIS is to interface with existing systems, some of which are to be decommissioned as the program is fully deployed. Table 14 describes the features of systems and services with which USCIS ELIS is planned to interface.

**Table 14: Interfaces Planned for USCIS ELIS**

Agency name	System name	System description
U.S. Customs and Border Protection	TECS (not an acronym)	Automated enforcement and inspection lookout system maintained by U.S. Customs and Border Protection that combines information from multiple agencies, databases, and system interfaces to compile data relating to national security risks, public safety issues, current or past targets of investigations, and other law enforcement concerns.
U.S. Customs and Border Protection	Arrival and Departure Information System	System for storage and use of biographic, biometric indicators, and encounter data on non-U.S. citizens and nationals who have applied for entry, entered, or departed the United States. It facilitates the investigation of subjects of interest who may have violated their immigration status by remaining in the United States beyond the date of their authorized stay.
Department of Homeland Security	Automated Biometric Identification System	Originally developed in 1994 as a law enforcement system for collecting and processing biometrics, this system has evolved over the years into the central DHS-wide system for the storage and processing of biometric data. It stores and processes digital fingerprints, photographs, iris scans, and facial images and links the biometrics with biographic information to establish and verify identity.
U.S. Immigration and Customs Enforcement	Enforcement Integrated Database	Database shared among several DHS law enforcement entities and with other DHS applications. It captures and maintains information related to the investigation, arrest, booking, detention, and removal of persons encountered during immigration and criminal law enforcement investigations and operations conducted by Immigration and Customs Enforcement and Customs and Border Protection.
U.S. Immigration and Customs Enforcement	Student Exchange Visitor Information System	System maintains real-time information on nonimmigrant students, exchange visitors, and their dependents.
Department of Labor	Immigration Certification Portal	System was developed for the Department of Labor, Employment and Training Administration, Office of Foreign Labor Certification to provide employers and their representatives (i.e., attorneys/agents) a secure and reliable means to access case information across all of the supported visa-type programs (H-1B) and to file prevailing wage requests.
Department of Justice	Executive Office Immigration Review	System contains case-related information pertaining to foreign nationals and alleged foreign nationals brought into the immigration hearing process, including certain foreign nationals previously or subsequently admitted for lawful permanent residence.

**Appendix IV: USCIS ELIS Interfaces**

<b>Agency name</b>	<b>System name</b>	<b>System description</b>
Federal Bureau of Investigation	Name Check	Service provides a name-based search of the FBI's Central Records System and Universal Index. USCIS sends applicant information (name, date of birth, country of birth, race, and gender) to the FBI in order to conduct the name check.
Federal Bureau of Investigation	Next Generation Identification	System offers biometric identification services as a repository of data on persons of special interest such as wanted persons and known or suspected terrorists.
Department of State	Consular Consolidated Database	Database holds current and archived data used by the Consular Affairs Bureau's domestic offices and overseas posts, such as the names, addresses, birthdates, biometric data, race, identification number (e.g. Social Security or alien registration number), and country of origin for U.S. persons (U.S. citizens and lawful permanent residents), as well as foreign nationals such as immigrant and nonimmigrant visa applicants.
Department of the Treasury	Pay.gov	Portal sends electronic payments and receipt of payment clearance verification. Services involve collection, billing, forms, and reporting.
Department of the Treasury	Collections Information Repository	Repository for supplying the latest information on deposits and details of collections transactions to federal agencies. System allows financial transaction information from all collections systems and settlement mechanisms to be exchanged in a single system.
USCIS	Alien Change of Address Card	System tracks address changes submitted to USCIS on the paper form (AR-11) and online through the Customer Relationship Interface System's change of address component.
USCIS	Central Index System	Database contains information on the status of applicants/petitioners seeking immigration benefits; supports legacy records management process that tracks the location of paper case files; interfaces with more than 20 internal DHS data systems and a small number of external governmental entities.
USCIS	Computer-Linked Adjudication Information Management System 3	Information in this and associated systems includes information provided by the applicant for an immigration benefit, and varies depending on the benefit. Also collects information to indicate which steps of the adjudication process have been completed, such as an appointment to submit biometrics for a background check, other pending benefits, and whether the applicant is suspected of fraudulent activity.
USCIS	Computer-Linked Application Information Management System 4	System tracks and processes applications for naturalization.
USCIS	Customer Profile Management System	A repository of all biometric data in USCIS.
USCIS	Customer Relationship Interface System	Web-based system that allows applicants with pending applications, petitions, or requests to check case status and estimated processing time; allows applicants to report a change of address. Can be used to record reported issues with pending cases such as typographical errors or non-receipt of a document and issue resolution.
USCIS	Enterprise Correspondence Handling On-line	Centralized data system with web-based user interfaces that replaced existing general support systems previously used at the various data centers. Used by Service Center personnel to generate various types of correspondence in processing forms.
USCIS	Enterprise Citizenship and Immigration Services Centralized Operational Repository	Repository for immigration and naturalization information, developed and implemented in an effort to streamline access to information by consolidating information from several other legacy systems. It will replicate and load read-only records from the Computer-Linked Adjudication Information Management Systems 3 and 4, Central Index System, and Refugee, Asylum, and Parole systems.

**Appendix IV: USCIS ELIS Interfaces**

<b>Agency name</b>	<b>System name</b>	<b>System description</b>
USCIS	Enterprise Print Management Service/Notice Generation Service	Service allows for notices to be printed and sent to customers, including notices of action and proofs of benefit. Examples include receipt notices, request for evidence, approval/denial notices, travel documents, permanent resident cards, and employment authorization documents.
USCIS	Fraud Detection and National Security Data System	Case management system used to record, track, and manage immigration inquiries, investigative referrals, law enforcement requests, and case determinations involving benefit fraud, criminal activity, public safety, and national security concerns.
USCIS	Identity Credential Access Management	System provides user authentication capability.
USCIS	Integrated Card Production System	System produces applicable documents when an immigration benefit is granted.
USCIS	InfoSphere Identity Insight	Tool that aggregates biographic data from USCIS ELIS, legacy USCIS data systems, and outside data sets. Capable of detecting duplicate accounts in USCIS ELIS, performing identity matches across legacy data, and revealing “obvious” and “non-obvious” relationships between identities.
USCIS	Enterprise Service Bus Lockbox Intake Service	Service acts as the intake for data received from the Lockbox service provider and delivers the data to the target USCIS system.
USCIS	Marriage Fraud Amendment System	System supports and maintains casework resulting from the Immigration Marriage Fraud Amendments of 1986 by providing aggregate and statistical information on casework operations, allowing employees to process and control applications and petitions to grant or terminate the resident status of aliens.
USCIS	National Appointment Scheduling System	An enterprisewide appointment scheduling system.
USCIS	Person Centric Query Service	Service provides the ability to submit a single query for all transactions involving an immigrant across a number of connected systems.
USCIS	Refugees, Asylum, and Parole System	Case management tool that enables USCIS to handle and process applications for asylum and applications for suspension of deportation or special rule cancellation of removal.
USCIS	Verification Information System	Composite information system verifies immigration status data from various DHS databases for benefits determination and employment authorization.

Source: GAO analysis of DHS and USCIS documentation. | GAO-16-467.

Note: This table does not include every system and service with which USCIS ELIS is planned to interface.

# Appendix V: Comments from the Department of Homeland Security

U.S. Department of Homeland Security  
Washington, DC 20528



**Homeland  
Security**

June 28, 2016

Carol R. Cha  
Director, Information Technology Acquisition Management Issues  
U.S. Government Accountability Office  
441 G Street, NW  
Washington, DC 20548

Re: Management's Response to Draft Report GAO-16-467, "IMMIGRATION BENEFITS SYSTEM: U.S. Citizenship and Immigration Services Can Improve Program Management"

Dear Ms. Cha:

Thank you for the opportunity to review and comment on this draft report. The Department of Homeland Security (DHS) appreciates the U.S. Government Accountability Office's (GAO) work in planning and conducting its review and issuing this report.

The Department is pleased to note GAO's positive recognition of progress made by the U.S. Citizenship and Immigration Services (USCIS) Transformation Program and its use of an Agile development approach. For example, the draft report highlighted USCIS' adherence to leading practices and agency guidance in its system integration and testing, and in monitoring the Transformation Program contractors. Additionally, GAO acknowledged that the Transformation Program has established a reliable estimate to monitor program cost and performance on an annual basis.

USCIS takes meeting Transformation Program expectations and needs very seriously and continues to implement evolving development practices, while at the same time, ensuring that its guidance and documentation are updated and remain consistent across all of USCIS. USCIS is experimenting with executing operations in a *DevOps* environment to allow shorter cycle times and faster delivery of business value. As these experiments are concluded, USCIS is updating the policies and processes across its Office of Information Technology to reflect the most up to date and modern developments, including following leading industry practices, as appropriate.

The draft report contained twelve recommendations with which the Department concurs. Please see the attached for our detailed response to each recommendation.

Again, thank you for the opportunity to review and comment on this draft report. Technical comments were previously provided under a separate cover. Please feel free to contact me if you have any questions. We look forward to working with you in the future.

Sincerely,



J. H. CRUMPACKER, CIA, CFE  
Director  
Departmental GAO-OIG Liaison Office

**Attachment: DHS Management Response to Recommendations  
Contained in GAO-16-467**

GAO recommended that the Secretary of Homeland Security direct the Director of USCIS to direct the USCIS Chief Information Officer (CIO), in coordination with the DHS CIO and the Chief of the Office of Transformation Coordination (OTC), to review and update, as needed, existing policies and guidance and consider additional controls to:

**Recommendation 1:** Complete planning for software releases prior to initiating development and ensure software meets business expectations prior to deployment.

**Response:** Concur. USCIS' Office of Information Technology (OIT), along with USCIS OTC, will use the time boxed planning method to ensure that sufficient planning is completed before development work is started and that the software meets USCIS business needs. USCIS will also refine its Agile policies based on current best practices and lessons learned. Estimated Completion Date (ECD): January 31, 2017.

**Recommendation 2:** Consistently implement the principles of the framework adopted for Agile software development.

**Response:** Concur. USCIS OIT and OTC will consistently implement the Agile frameworks that have been defined at USCIS, including a process of continuous improvement. USCIS OIT and OTC will appropriately document what framework each program is following, with an acknowledgement that because of continuous improvements, the frameworks used may diverge from their textbook definitions. USCIS OIT is updating the Agile policies for all USCIS applications based on current best practices and lessons learned. ECD: January 31, 2017.

**Recommendation 3:** Define and consistently execute appropriate roles and responsibilities for individuals responsible for development activities consistent with its selected framework.

**Response:** Concur. USCIS is moving towards the enterprise-wide use of the *DevOps* model for the delivery of software to allow for shorter cycle times and better delivery of business value. USCIS OIT will provide guidance that requires each team developing the software to have the requisite skillsets. In those instances where USCIS is not executing per the *DevOps* model, the roles and responsibilities are already well defined. USCIS OIT is also refining its policies for *DevOps* implementation and will document these revisions in the Agile policies. ECD: January 31, 2017.

**Recommendation 4:** Identify all system users and involve them in release planning activities.

**Response:** Concur. USCIS OIT and OTC strive to have representative users involved throughout the development process, including release planning, user story creation and grooming, development, and testing. Through the use of sprint demonstrations, USCIS OIT and OTC will engage a larger audience for feedback. Specifically, USCIS OIT and OTC will create regular review sessions, coordinate demonstrations, obtain feedback from the field offices, and integrate the feedback, as appropriate. ECD: January 31, 2017.

**Recommendation 5:** Write user stories that identify user roles, include estimates of complexity, take no longer than one sprint to complete, and describe business value.

**Response:** Concur. USCIS' OIT and OTC currently follow a user story process where both written and oral communication ensures that the information necessary to understand user roles and business value is shared. USCIS OIT and OTC have followed this process since Agile policies were implemented in April 2013. Therefore, we request that GAO consider this recommendation resolved and closed, as implemented.

**Recommendation 6:** Establish outcomes for Agile software development.

**Response:** Concur. USCIS OIT and OTC already establish expected outcomes in the Capabilities and Constraints document, and these are updated and reviewed as the programs evolve, at a minimum during every Release Planning Review. Both USCIS OIT and OTC are also experimenting with Value Delivery Registers to validate the actual business outcomes achieved from a program. ECD: January 31, 2017.

**Recommendation 7:** Monitor program performance and report to appropriate entities through the collection of reliable metrics.

**Response:** Concur. USCIS OIT and OTC are updating guidance regarding the collection of metrics for the Transformation Program, and are expanding the number of metrics to include a better representation of actions. Additionally, USCIS OIT is investigating options for automatically collecting and calculating data for performance metrics. ECD: January 31, 2017.

GAO also recommended that the Secretary of Homeland Security direct the Director of USCIS to direct the USCIS CIO to review and update existing policies and guidance and consider additional controls to:

**Recommendation 8:** Conduct unit and integration, and functional acceptance tests, and code inspection consistent with stated program goals.



**Response:** Concur. USCIS OIT and OTC will continue to expand its automated testing across all areas of an application where it is feasible and will reduce risk. USCIS OIT and OTC are also revising the Test and Evaluation Master Plan to accurately reflect the best return on investment for an application. The code inspection methods will continue to evolve and will remain a focus and important part of validating quality of delivery. ECD: January 31, 2017.

**Recommendation 9:** Develop complete test plans and cases for interoperability and end user testing, as defined in the *USCIS Transformation Program Test and Evaluation Master Plan*, and document the results.

**Response:** Concur. USCIS OIT and OTC will develop appropriate test plans and cases for complete testing of the application that emphasize automation, while also using manual testing for exploratory testing or when otherwise necessary. Both offices are also in the process of revising the Test and Evaluation Master Plan to more accurately reflect the various types of testing and associated metrics for automated testing. Finally, USCIS OIT is moving toward more consistent and regular interface testing and interoperability testing. ECD: January 31, 2017.

GAO also recommended that the Secretary of Homeland Security direct the Director of USCIS to direct the Chief of the USCIS Contracting Office, in coordination with the appropriate contracting officer, to consider inconsistencies between policies and leading practices in contract administration and as needed, institute controls to:

**Recommendation 10:** Clearly define measures against which to analyze differences between services expected and those delivered.

**Response:** Concur. USCIS' Office of Contracting (OCON) is in the process of modifying the scorecard requirements to align the seven performance elements identified in the performance work statement with the existing scorecard. This change will also be implemented in the follow-on contract. To minimize future risks, OCON will provide internal training emphasizing the use of consistent and clearly defined measures to monitor contractor performance. OCON will also include this topic for discussion at an upcoming Contracting Officer's working group, provide an office-wide reminder to all OCON staff, and include this information in upcoming training sessions for contracting officer representatives (COR) and project managers. ECD: July 31, 2017.

**Recommendation 11:** Maintain complete contract files.

**Response:** Concur. USCIS agrees that CORs should maintain complete contract files. OCON will continue to conduct training designed to increase the awareness of the requirement for CORs to maintain complete COR files. This topic will be included on the agenda for the upcoming 4<sup>th</sup> Quarter COR roundtable and was part of the annual on-site

COR training in June 2016. Contracting Officer/Contracts Specialists will be trained as well, which will increase the awareness within OCON and prompt staff to emphasize the requirement of maintaining complete contract files as part of their day-to-day interactions with CORs.

In addition, OCON will commence the practice of conducting recurring annual audits on COR files. The first audit is scheduled to be completed by March 31, 2017, and will include 100 percent of our existing Transformation contracts as well as a random sample of all other COR files within USCIS. ECD: March 31, 2017.

**Recommendation 12:** Ensure quality assurance surveillance plans are developed when appropriate.

**Response:** Concur. USCIS' OCON will conduct a variety of training events to increase awareness of this requirement. This topic will be discussed at an upcoming Contracting Officer's working group and an office-wide reminder will be distributed. This requirement will also be emphasized with the Procurement Analysts staff who conduct file reviews as part of their continued focus on reviews and audits.

OCON will conduct an internal audit on USCIS contracts to ensure that a Quality Assurance Surveillance Plan (QASP) has been developed when appropriate for performance based acquisitions. In instances where a QASP was required and not incorporated, OCON will develop the appropriate QASP. ECD: January 31, 2017.

---

# Appendix VI: GAO Contact and Staff Acknowledgments

---

## GAO Contact

Carol C. Harris at (202) 512-4456 or [chac@gao.gov](mailto:chac@gao.gov)

---

## Staff Acknowledgments

In addition to the contact named above, Michael Holland (Assistant Director), Mathew Bader (Analyst in Charge), Carl Barden, Naba Barkakati, Jennifer Beddor, Christopher Businsky, Juana Collymore, Philip Curtin, Nancy Glover, Julianne Gorse, Franklin Jackson, Richard Sayoc and Martin Skorczynski made contributions to this report.

---

# Appendix VII: Accessible Data

---

## Agency Comment Letter

---

Text of Appendix V:  
Comments from the  
Department of Homeland  
Security

---

Page 1

U.S. Department of Homeland Security Washington, DC 20528

Homeland Security

June 28, 2016

Carol R. Cha

Director, Information Technology Acquisition Management Issues

U.S. Government Accountability Office

441 G Street, NW

Washington, DC 20548

Re: Management's Response to Draft Report GA0-16-467,  
"IMMIGRATION BENEFITS SYSTEM: U.S. Citizenship and Immigration  
Services Can Improve Program Management"

Dear Ms. Cha:

Thank you for the opportunity to review and comment on this draft report. The Department of Homeland Security (DHS) appreciates the U.S. Government Accountability Office's (GAO) work in planning and conducting its review and issuing this report.

The Department is pleased to note GAO's positive recognition of progress made by the U.S. Citizenship and Immigration Services (USCIS) Transformation Program and its use of an Agile development approach. For example, the draft report highlighted USCIS' adherence to leading practices and agency guidance in its system integration and testing, and

---

in monitoring the Transformation Program contractors. Additionally, GAO acknowledged that the Transformation Program has established a reliable estimate to monitor program cost and performance on an annual basis.

USCIS takes meeting Transformation Program expectations and needs very seriously and continues to implement evolving development practices, while at the same time, ensuring that its guidance and documentation are updated and remain consistent across all of USCIS. USCIS is experimenting with executing operations in a DevOps environment to allow shorter cycle times and faster delivery of business value. As these experiments are concluded, USCIS is updating the policies and processes across its Office of Information Technology to reflect the most up to date and modern developments, including following leading industry practices, as appropriate.

The draft report contained twelve recommendations with which the Department concurs. Please see the attached for our detailed response to each recommendation.

---

Page 2

Again, thank you for the opportunity to review and comment on this draft report. Technical comments were previously provided under a separate cover. Please feel free to contact me if you have any questions. We look forward to working with you in the future.

Sincerely,

JIM H. CRUMPACKER, CIA, CFE

Director

Departmental GAO-OIG Liaison Office

---

Page 3

Attachment: DHS Management Response to Recommendations  
Contained in GA0-16-467

GAO recommended that the Secretary of Homeland Security direct the Director of USCIS to direct the USCIS Chief Information Officer (CIO), in coordination with the DHS CIO and the Chief of the Office of Transformation Coordination (OTC), to review and update, as needed, existing policies and guidance and consider additional controls to:

Recommendation 1: Complete planning for software releases prior to initiating development and ensure software meets business expectations prior to deployment.

Response: Concur. USCIS' Office of Information Technology (OIT), along with USCIS OTC, will use the time boxed planning method to ensure that sufficient planning is completed before development work is started and that the software meets USCIS business needs. USCIS will also refine its Agile policies based on current best practices and lessons learned. Estimated Completion Date (ECD): January 31, 2017.

Recommendation 2: Consistently implement the principles of the framework adopted for Agile software development.

Response: Concur. USCIS OIT and OTC will consistently implement the Agile frameworks that have been defined at USCIS, including a process of continuous improvement. USCIS OIT and OTC will appropriately document what framework each program is following, with an acknowledgement that because of continuous improvements, the frameworks used may diverge from their textbook definitions. USCIS OIT is updating the Agile policies for all USCIS applications based on current best practices and lessons learned. ECD: January 31, 2017.

Recommendation 3: Define and consistently execute appropriate roles and responsibilities for individuals responsible for development activities consistent with its selected framework.

Response: Concur. USCIS is moving towards the enterprise-wide use of the DevOps model for the delivery of software to allow for shorter cycle times and better delivery of business value. USCIS OIT will provide guidance that requires each team developing the software to have the requisite skillsets. In those instances where USCIS is not executing per the DevOps model, the roles and responsibilities are already well defined. USCIS OIT is also refining its policies for DevOps implementation and will document these revisions in the Agile policies. ECD: January 31, 2017.

---

Page 4

Recommendation 4: Identify all system users and involve them in release planning activities.

Response: Concur. USCIS OIT and OTC strive to have representative users involved throughout the development process, including release planning, user story creation and grooming, development, and testing. Through the use of sprint demonstrations, USCIS OIT and OTC will

engage a larger audience for feedback. Specifically, USCIS OIT and OTC will create regular review sessions, coordinate demonstrations, obtain feedback from the field offices, and integrate the feedback, as appropriate. ECD: January 31, 2017.

Recommendation 5: Write user stories that identify user roles, include estimates of complexity, take no longer than one sprint to complete, and describe business value.

Response: Concur. USCIS' OIT and OTC currently follow a user story process where both written and oral communication ensures that the information necessary to understand user roles and business value is shared. USCIS OIT and OTC have followed this process since Agile policies were implemented in April 2013. Therefore, we request that GAO consider this recommendation resolved and closed, as implemented.

Recommendation 6: Establish outcomes for Agile software development.

Response: Concur. USCIS OIT and OTC already establish expected outcomes in the Capabilities and Constraints document, and these are updated and reviewed as the programs evolve, at a minimum during every Release Planning Review. Both USCIS OIT and OTC are also experimenting with Value Delivery Registers to validate the actual business outcomes achieved from a program. ECD: January 31, 2017.

Recommendation 7: Monitor program performance and report to appropriate entities through the collection of reliable metrics.

Response: Concur. USCIS OIT and OTC are updating guidance regarding the collection of metrics for the Transformation Program, and are expanding the number of metrics to include a better representation of actions. Additionally, USCIS OIT is investigating options for automatically collecting and calculating data for performance metrics. ECD: January 31, 2017.

GAO also recommended that the Secretary of Homeland Security direct the Director of USCIS to direct the USCIS CIO to review and update existing policies and guidance and consider additional controls to:

Recommendation 8: Conduct unit and integration, and functional acceptance tests, and code inspection consistent with stated program goals.

Response: Concur. USCIS OIT and OTC will continue to expand its automated testing across all areas of an application where it is feasible and will reduce risk. USCIS OIT and OTC are also revising the Test and Evaluation Master Plan to accurately reflect the best return on investment for an application. The code inspection methods will continue to evolve and will remain a focus and important part of validating quality of delivery. ECD: January 31, 2017.

Recommendation 9: Develop complete test plans and cases for interoperability and end user testing, as defined in the USCIS Transformation Program Test and Evaluation Master Plan, and document the results.

Response: Concur. USCIS OIT and OTC will develop appropriate test plans and cases for complete testing of the application that emphasize automation, while also using manual testing for exploratory testing or when otherwise necessary. Both offices are also in the process of revising the Test and Evaluation Master Plan to more accurately reflect the various types of testing and associated metrics for automated testing. Finally, USCIS OIT is moving toward more consistent and regular interface testing and interoperability testing. ECD: January 31, 2017.

GAO also recommended that the Secretary of Homeland Security direct the Director of USCIS to direct the Chief of the USCIS Contracting Office, in coordination with the appropriate contracting officer, to consider inconsistencies between policies and leading practices in contract administration and as needed, institute controls to:

Recommendation 10: Clearly define measures against which to analyze differences between services expected and those delivered.

Response: Concur. USCIS' Office of Contracting (OCON) is in the process of modifying the scorecard requirements to align the seven performance elements identified in the performance work statement with the existing scorecard. This change will also be implemented in the follow-on contract. To minimize future risks, OCON will provide internal training emphasizing the use of consistent and clearly defined measures to monitor contractor performance. OCON will also include this topic for discussion at an upcoming Contracting Officer's working group, provide an office-wide reminder to all OCON staff, and include this information in upcoming training sessions for contracting officer representatives (COR) and project managers. ECD: July 31, 2017.



Recommendation 11: Maintain complete contract files.

Response: Concur. USCIS agrees that CORs should maintain complete contract files. OCON will continue to conduct training designed to increase the awareness of the requirement for CORs to maintain complete COR files. This topic will be included on the agenda for the upcoming 4th Quarter COR roundtable and was part of the annual on-site

Page 6

COR training in June 2016. Contracting Officer/Contracts Specialists will be trained as well, which will increase the awareness within OCON and prompt staff to emphasize the requirement of maintaining complete contract files as part of their day-to-day interactions with CORs.

In addition, OCON will commence the practice of conducting recurring annual audits on COR files. The first audit is scheduled to be completed by March 31, 2017, and will include 100 percent of our existing Transformation contracts as well as a random sample of all other COR files within USCIS . ECD: March 31, 2017.

Recommendation 12: Ensure quality assurance surveillance plans are developed when appropriate.

Response: Concur. USCIS' OCON will conduct a variety of training events to increase awareness of this requirement. This topic will be discussed at an upcoming Contracting Officer's working group and an office-wide reminder will be distributed. This requirement will also be emphasized with the Procurement Analysts staff who conduct file reviews as part of their continued focus on reviews and audits.

OCON will conduct an internal audit on USCIS contracts to ensure that a Quality Assurance Surveillance Plan (QASP) has been developed when appropriate for performance based acquisitions. In instances where a QASP was required and not incorporated, OCON will develop the appropriate QASP. ECD: January 31, 2017.

## Data Tables

### Accessible Text for Figure 2: Organizational Structure for the Office of Transformation Coordination

#### Office of Transformation Coordination:

- Program and Resource Management Division
- Stakeholder Engagement Division

- Business Integration Division
- Capability Delivery Division

---

**Accessible Text for Figure 3: Organizational Structure for the Office of Information Technology**

**Chief Information Officer:**

- Enterprise Infrastructure Division
- End User Services Division
- Systems Development Division
- Resource Management Division
- Information Security Division
- Applied Technology Division
  1. Delivery Assurance Branch
  2. Agile Coaching and Testing Branch

---

**Accessible Text for Figure 7: Traceability from Operational Requirements to User Stories**

1. Operating Requirements
2. Capabilities
3. Features
4. Sub-Features
5. User Stories

---

---

## GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

---

## Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's website (<http://www.gao.gov>). Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. To have GAO e-mail you a list of newly posted products, go to <http://www.gao.gov> and select "E-mail Updates."

---

## Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, <http://www.gao.gov/ordering.htm>.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

---

## Connect with GAO

Connect with GAO on [Facebook](#), [Flickr](#), [Twitter](#), and [YouTube](#).  
Subscribe to our [RSS Feeds](#) or [E-mail Updates](#).  
Listen to our [Podcasts](#) and read [The Watchblog](#).  
Visit GAO on the web at [www.gao.gov](http://www.gao.gov).

---

## To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Website: <http://www.gao.gov/fraudnet/fraudnet.htm>

E-mail: [fraudnet@gao.gov](mailto:fraudnet@gao.gov)

Automated answering system: (800) 424-5454 or (202) 512-7470

---

## Congressional Relations

Katherine Siggerud, Managing Director, [siggerudk@gao.gov](mailto:siggerudk@gao.gov), (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548

---

## Public Affairs

Chuck Young, Managing Director, [youngc1@gao.gov](mailto:youngc1@gao.gov), (202) 512-4800  
U.S. Government Accountability Office, 441 G Street NW, Room 7149  
Washington, DC 20548