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Testimony

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CUSTOMS SERVICE MODERNIZATION

Actions Initiated to Correct ACE Management and Technical Weaknesses

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Mr. Chairman and Members of the Committee:

Thank you for inviting me to participate in today's Customs Service oversight hearing. My statement will focus on Customs' Automated Commercial Environment, better known as ACE. Through ACE, Customs intends to implement much needed improvements in the way it currently enforces import trade laws and regulations, and assesses and collects import duties, taxes, and fees, which total $22 billion annually.

The need to leverage information technology (IT) to improve the way that Customs does business in the import arena is undeniable. Customs' existing import processes and supporting systems are simply not responsive to the business needs of either Customs or the trade community, whose members collectively import about $1 trillion in goods annually. These existing processes and systems are paper-intensive, error-prone, and transaction-based, and they are out of step with the just-in-time inventory practices used by the trade. Recognizing this, Congress enacted the Customs Modernization and Informed Compliance Act, or "Mod" Act, to define legislative requirements for improving import processing through an automated system.[1]

Customs fully recognizes the severity of the problems with its approach to managing import trade and is modernizing its import processes and undertaking ACE as its import system solution. Begun in 1994, Customs' estimate of the system's 15-year life cycle cost is about $1.05 billion, although this estimate is being revised upwards. In light of ACE's enormous mission importance and price tag, Customs' approach to investing in and engineering ACE demands disciplined and rigorous management practices. Such practices are embodied in the Clinger-Cohen Act of 1996[2] and other legislative and regulatory requirements, as well as

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[1]Customs refers to Title VI of the North American Free Trade Agreement Implementation Act (Public Law 103-182, 19 U.S.C. 1411 et seq) as the Customs Modernization and Informed Compliance Act or "Mod" Act.

[2]Although the Clinger-Cohen Act (Public Law 104-106) was passed after Customs began developing ACE, its principles are based on practices that are widely considered to be integral to successful IT investments. For an analysis of the management practices of several leading private and public sector organizations on which the Clinger-Cohen Act is based, see Executive Guide: Improving Mission Performance Through Strategic Information Management and Technology (GAO/AIMD-94-115, May 1994). For an overview of the IT management process envisioned by Clinger-Cohen, see Assessing Risk and Returns: A Guide for Evaluating Federal Agencies' IT Investment Decision-making (GAO/AIMD-10.1.13, February 1997).

accepted industry system/software engineering models, such as those published by the Software Engineering Institute (SEI).[3]

Unfortunately, Customs has not employed such practices on ACE over the last 5 years. Our February 1999 report on ACE,[4] upon which my testimony today is based, describes serious ACE management and technical weaknesses. The weaknesses that we reported are (1) building ACE without a complete and enforced enterprise systems architecture, (2) investing in ACE without a firm basis for knowing that it is a cost-effective system solution, and (3) building ACE without employing engineering rigor and discipline. My testimony will address each of these points as well as our recommendations for correcting them. To Customs' credit, its leadership has agreed with our findings, has initiated actions to implement our recommendations, and is committed to seeing that these actions are completed before investing huge sums of money in the system.

ACE: A Brief History

Customs began ACE in 1994, and its early estimate of the cost and time to develop the system was $150 million over 10 years. At this time, Customs also decided to first develop a prototype of ACE, referred to as NCAP (National Customs Automation Program prototype), and then to complete the system. In May 1997,[5] we testified that Customs' original schedule for completing the prototype was January 1997, and that Customs did not have a schedule for completing ACE. At that time, Customs agreed to develop a comprehensive project plan for ACE.

In November 1997, Customs estimated that the system would cost $1.05 billion to develop, operate, and maintain throughout its life cycle. Customs plans to develop and deploy the system in 21 increments from 1998 through 2005, the first four of which would constitute NCAP.

Currently, Customs is well over 2 years behind its original NCAP schedule. Because Customs experienced problems in developing NCAP software in-

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[3]Software Development Capability Maturity Model[SM] (SW-CMM[®]) and Software Acquisition Capability Maturity Model[SM] (SA-CMM[®]). Capability Maturity Model[SM] is a service mark of Carnegie Mellon University, and CMM[®] is registered in the U.S. Patent and Trademark Office.

[4]Customs Service Modernization: Serious Management and Technical Weaknesses Must Be Corrected (GAO/AIMD-99-41, February 26, 1999).

[5]Customs Service Modernization: ACE Poses Risks and Challenges (GAO/T-AIMD-97-96, May 15, 1997).

house, the first NCAP release was not deployed until May 1998--16 months late. In view of the problems it experienced with the first release, Customs contracted out for the second NCAP release, and deployed this release in October 1998--21 months later than originally planned. Customs' most recent dates for deploying the final two NCAP releases (0.3 and 0.4) are March 1999 and September 1999, which are 26 and 32 months later than the original deployment estimates, respectively. According to Customs, these dates will slip farther because of funding delays.

Additionally, Customs officials told us that a new ACE life cycle cost estimate is being developed, but that it was not ready to be shared with us. At the time of our review, Customs' $1.05 billion estimate developed in 1997 was the official ACE life cycle cost estimate. However, a January 1999 ACE business plan specifies a $1.48 billion life cycle cost estimate.

Customs Has Been Developing ACE Without a Complete Enterprise Systems Architecture

At the time of our review, Customs was not building ACE within the context of an enterprise systems architecture, or "blueprint" of its agencywide future systems environment. Such an architecture is a fundamental component of any rationale and logical strategic plan for modernizing an organization's systems environment. As such, the Clinger-Cohen Act requires agency Chief Information Officers (CIO) to develop, maintain, and implement an information technology architecture. Also, the Office of Management and Budget (OMB) issued guidance in 1996 that requires agency IT investments to be architecturally compliant. These requirements are consistent with, and in fact based on, information technology management practices of leading private and public sector organizations.

Simply stated, an enterprise systems architecture specifies the system (e.g., software, hardware, communications, security, and data) characteristics that the organization's target systems environment is to possess. Its purpose is to define, through careful analysis of the organization's strategic business needs and operations, the future systems configuration that supports not only the strategic business vision and concept of operations, but also defines the optimal set of technical standards that should be met to produce homogeneous systems that can interoperate effectively and be maintained efficiently. Our work has shown that in the absence of an enterprise systems architecture, incompatible systems are produced that

require additional time and resources to interconnect and to maintain and that suboptimize the organization's ability to perform its mission.[6]

We first reported on Customs' need for a systems architecture in May 1996 and testified on this subject in May 1997.[7] In response, Customs developed and published an architecture in July and August 1997. We reviewed this architecture and reported in May 1998 that it was not effective because it was neither complete nor enforced.[8] For example, the architecture did not

1. fully describe Customs' business functions and their relationships,

2. define the information needs and flows among these functions, and

3. establish the technical standards, products, and services that would be characteristic of its target systems environment on the basis of these business specifications.

Accordingly, we recommended that Customs complete its enterprise information systems architecture and establish compliance with the architecture as a requirement of Customs' information technology investment management process. In response, Customs agreed to develop a complete architecture and establish a process to ensure compliance. Customs reports that its architecture will be completed in May 1999. Also, in January 1999, Customs changed its internal procedures to provide for effective enforcement of its architecture, once it is completed. Until the architecture is completed and enforced, Customs risks spending millions of dollars to develop, acquire, and maintain information systems, including ACE, that do not effectively and efficiently support the agency's mission needs.

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[6]Air Traffic Control: Complete and Enforced Architecture Needed for FAA Systems Modernization (GAO/AIMD-97-30, February 3, 1997).

[7]Customs Service Modernization: Strategic Information Management Must Be Improved for National Automation Program To Succeed (GAO/AIMD-96-57, May 9, 1996) and Customs Service Modernization: ACE Poses Risks and Challenges (GAO/T-AIMD-97-96, May 15, 1997).

[8]Customs Service Modernization: Architecture Must Be Complete and Enforced to Effectively Build and Maintain Systems (GAO/AIMD-98-70, May 5, 1998).

Customs Has Not Been Managing Its Investment in ACE Effectively

Effective IT investment management is predicated on answering one basic question: Is the organization doing the "right thing" by investing specified time and resources in a given project or system? The Clinger-Cohen Act and OMB and GAO guidance together provide an effective IT investment management framework for answering this question. Among other things, they describe the need for

1. identifying and analyzing alternative system solutions,

2. developing reliable estimates of the alternatives' respective costs and benefits and investing in the most cost-beneficial alternative, and

3. to the maximum extent practical, structuring major projects into a series of increments to ensure that each increment constitutes a wise investment.

Customs did not satisfy any of these requirements for ACE. First, Customs did not identify and evaluate a full range of alternatives to its defined ACE solution before commencing development activities. For example, Customs did not consider how ACE would relate to another Treasury-proposed system for processing import trade data, known as the International Trade Data System (ITDS), including considering the extent to which ITDS should be used to satisfy needed import processing functionality. Initiated in 1995 as a project to develop a coordinated, governmentwide system for the collection, use, and dissemination of trade data, the ITDS project is headed by the Treasury Deputy Assistant Secretary for Regulatory, Tariff and Trade Enforcement. The system is expected to reduce the burden federal agencies place on organizations by requiring that they respond to duplicative data requests. Treasury intends for the system to serve as the single point for collecting, editing, and validating trade data as well as collecting and accounting for trade revenue. At the time of our review of ACE, these functions were also planned for ACE.

Similarly, Customs did not evaluate different ACE architectural designs, such as the use of a mainframe-based versus client/server-based hardware architecture. Also, Customs did not evaluate alternative development approaches, such as acquisition versus in-house development. In short, Customs committed to and began building ACE without knowing whether it had chosen the most cost-effective alternative and approach.

Second, Customs did not develop a reliable life cycle cost estimate for the approach it selected. SEI has developed a method for project managers to use to determine the reliability of project cost estimates. Using SEI's method, we found that Customs' $1.05 billion ACE life cycle cost estimate was not reliable, and that it did not provide a sound basis for Customs' decision to invest in ACE. For example, in developing the cost estimate, Customs did not (1) use a cost model, (2) account for changes in its approach to building different ACE increments, (3) account for changes to ACE software and hardware architecture, or (4) have historical project cost data upon which to compare its ACE estimate.

Moreover, the $1.05 billion cost estimate used to economically justify ACE omitted relevant costs. For instance, the costs of technology refreshment and system requirements definition were not included (see table 1). Exacerbating this problem, Customs represented its ACE cost estimate as a precise point estimate rather than explicitly disclosing to investment decisionmakers in Treasury, OMB, and Congress the estimate's inherent uncertainty.

Table 1: Estimated Costs Omitted From Customs' ACE Cost-Benefit Analysis

Excluded cost description	Excluded cost estimate
Hardware and software upgrades at each port office (e.g., desktop workstations and operating systems, application and data servers, and database management systems).	$73 to $172 million
Security analysis, project planning and management, and independent verification and validation.	$23 million
Requirements definition, component integration, regression testing, and training.	No estimate available

Customs' projections of ACE benefits were also unreliable because they were either overstated or unsupported. For example, the analysis includes $203.5 million in savings attributable to 10 years of avoided maintenance and support costs on the Automated Commercial System (ACS)--the system ACE is to replace. However, Customs would not have avoided maintenance and support costs for 10 years. At the time of Customs' analysis, it planned to run both systems in parallel for 4 years, and thus planned to spend about $53 million on ACS maintenance and support during this period. As another example, $650 million in savings was not supported by verifiable data or analysis, and $644 million was based on

assumptions that were analytically sensitive to slight changes, making this $644 million a "best case" scenario.

Third, Customs is not making its investment decisions incrementally as required by the Clinger-Cohen Act and OMB. Although Customs has decided to implement ACE as a series of 21 increments, it is not justifying investing in each increment on the basis of defined costs and benefits and a positive return on investment for each increment. Further, once it has deployed an increment at a pilot site for evaluation, it is not validating the benefits that the increment actually provides, and it is not accounting for costs on each increment so that it can demonstrate that a positive return on investment was actually achieved. Instead, Customs estimated the costs and benefits for the entire system--all 21 increments, and used this as economic justification for ACE.

Mr. Chairman, our work has shown that such estimates of many system increments to be delivered over many years are impossible to make accurately because later increments are not well understood or defined. Also, these estimates are subject to change in light of experiences on nearer term increments and changing business needs. By using an inaccurate, aggregated estimate that is not refined as increments are developed, Customs is committing enormous resources with no assurance that it will achieve a reasonable return on its investment. This "grand design" approach to managing large system modernization projects has repeatedly proven to be ineffective across the federal government, resulting in huge sums invested in systems that do not provide expected benefits. Failure of the grand design approach was a major impetus for the IT management reforms contained in the Clinger-Cohen Act.

Customs Has Not Been Managing ACE Software Development/ Acquisition Effectively

Software process maturity is one important and recognized measure of determining whether an organization is managing a system or project the "right way," and thus whether or not the system will be completed on time and within budget and will deliver promised capabilities. The Clinger-Cohen Act requires agencies to implement effective IT management processes, such as processes for managing software development and acquisition. SEI has developed criteria for determining an organization's software development and acquisition effectiveness or maturity.

Customs lacks the capability to effectively develop or acquire ACE software. Using SEI criteria for process maturity at the "repeatable" level, which is the second level on SEI's five-level scale and means that an

organization has the software development/acquisition rigor and discipline
to repeat project successes, we evaluated ACE software processes. In
February 1999,[9] we reported that the software development processes that
Customs was employing on NCAP 0.1, the first release of ACE, were not
effective. For example, we reported that Customs lacked effective
software configuration management, which is important for establishing
and maintaining the integrity of the software products during development.
Also, we reported that Customs lacked a software quality assurance
program, which greatly increased the risk of ACE software not meeting
process and product standards. Further, we reported that Customs lacked
a software process improvement program to effectively address these and
other software process weaknesses. Our findings concerning ACE
software development maturity are summarized in table 2.

Table 2: Summary of ACE Software Development Maturity

Key process areas	Satisfied	Not satisfied
Requirements management		X
Software project planning		X
Software project tracking and oversight		X
Software quality assurance		X
Software configuration management		X

Note: These represent five of six level 2 key process areas in SEI's Software Development Capability
Maturity Model. We did not evaluate ACE in the sixth level 2 key process area--software subcontract
management--because Customs did not use subcontractors on ACE.

As discussed in our brief history of ACE, after Customs developed NCAP
0.1 in-house, it decided to contract out for the development of NCAP 0.2,
thus changing its role on ACE from being a software developer to being a
software acquirer. According to SEI, the capabilities needed to effectively
acquire software are different than the capabilities needed to effectively
develop software. Regardless, we reported later in February 1999[10] that
the software acquisition processes that Customs was employing on NCAP
0.2 were not effective. For example, Customs did not have an effective
software acquisition planning process and, as such, could not effectively

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[9]Customs Service Modernization: Ineffective Software Development Processes Increase Customs
System Development Risks (GAO/AIMD-99-35, February 11, 1999).

[10]GAO/AIMD-99-41, February 26, 1999.

establish reasonable plans for performing software engineering and for managing the software project. Also, Customs did not have an effective evaluation process, meaning that it lacked the capability for ensuring that contractor-developed software satisfied defined requirements. Our findings concerning ACE software acquisition maturity are summarized in table 3.

Table 3: Summary of ACE Software Acquisition Maturity

Key process areas	Satisfied	Not satisfied
Software acquisition planning		X
Solicitation		X
Requirements development and management		X
Project office management		X
Contract tracking and oversight		X
Evaluation		X
Transition and support		X
Acquisition risk management		X

Note: These represent seven level 2 key process areas in SEI's Software Acquisition Capability Maturity Model. We also evaluated one key process area associated with the "defined" level of process maturity (level 3)--acquisition risk management.

Customs Has Initiated Actions to Implement Our Recommendations for Strengthening ACE Management

To address ACE management weaknesses, we recommended that Customs

- analyze alternative approaches to satisfying its import automation needs, including addressing the ITDS/ACE relationship;
- invest in its defined ACE solution incrementally, meaning for each system increment (1) rigorously estimate and analyze costs and benefits, (2) require a favorable return-on-investment and compliance with Customs' enterprise systems architecture, and (3) validate actual costs and benefits once an increment is piloted, compare actuals to estimates, use the results in deciding on future increments, and report the results to congressional authorizers and appropriators;
- establish an effective software process improvement program and correct the software process weaknesses identified in our report, thereby bringing ACE software process maturity to a least an SEI level 2; and
- require at least SEI level 2 processes of all ACE software contractors.

In commenting on our February 1999 report, the Commissioner of Customs agreed with our findings and committed to implementing our recommendations. In April 13, 1999, testimony, the Commissioner outlined several actions Customs has underway to improve ACE project management and address our recommendations.[11] In brief, Customs

- plans to acquire the services of a prime contractor that is at least SEI level 3 certified to help Customs implement mature software processes and plan, implement, and manage its modernization efforts, including ACE;
- plans to hire a Federally Funded Research and Development Center (FFRDC) to support solicitation, selection, contract award, contract management, and ongoing oversight of the prime contractor;
- has hired a contractor to update and improve the ACE life cycle cost estimate;
- has retained an audit firm to provide independent reviews of Customs' methodology for estimating ACE costs and revised cost/benefit analysis;
- has engaged a contractor to update and improve the ACE cost/benefit analysis by addressing our concerns, including use of ITDS as the interface for ACE;
- plans to perform additional cost/benefit analyses of ACE increments and analyze alternative approaches to building ACE; and
- plans to ensure that each ACE increment is compliant with Customs' enterprise systems architecture.

Conclusions

Successful systems modernization is absolutely critical to Customs' ability to perform its trade import mission efficiently and effectively in the 21st century. Systems modernization success, however, depends on doing the "right thing, the right way." To be "right," organizations must (1) invest in and build systems within the context of a complete and enforced enterprise systems architecture, (2) make informed, data-driven decisions about investment options based on expected and actual return-on-investment for system increments, and (3) build system increments using mature software engineering practices. Our reviews of agency system modernization efforts over the last 5 years point to weaknesses in these three areas as the root

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[11]Statement of Commissioner Raymond W. Kelly, Commissioner of the Customs Service, Authorization Hearing with the Customs Service Before the House Committee on Ways and Means Trade Subcommittee, April 13, 1999.

causes of their not delivering promised system capabilities on time and within budget.[12]

Until Customs corrects its ACE management and technical weaknesses, the federal government's troubled experience on other modernization efforts is a good indicator for ACE. In fact, although Customs does not collect data to know whether the first two ACE releases are already falling short of cost and performance expectations, the data it does collect on meeting milestones show that the first two releases have taken about 2 years longer than originally planned. This is precisely the type of unaffordable outcome that can be avoided by making the management and technical improvements we recommended.

To Customs' credit, it fully recognizes the seriousness of the situation, has quickly initiated actions to begin correcting its ACE management and technical weaknesses, and is committed to each of these actions. We are equally committed to working with Customs as it strives to do so and with Congress as it oversees this important initiative.

This concludes my statement. I would be glad to respond to any questions that you or other Members of the Committee may have at this time.

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[12]Tax System Modernization: Management and Technical Weaknesses Must Be Corrected If Modernization Is to Succeed (GAO/AIMD-95-156, July 26, 1995); Tax Systems Modernization: Actions Underway but IRS Has Not Yet Corrected Management and Technical Weaknesses (GAO/AIMD-96-106, June 7, 1996); Tax Systems Modernization: Blueprint Is a Good Start but Not Yet Sufficiently Complete to Build or Acquire Systems (GAO/AIMD/GGD-98-54, February 24, 1998); Air Traffic Control: Immature Software Acquisition Processes Increase FAA System Acquisition Risks (GAO/AIMD-97-47, March 21, 1997); Air Traffic Control: Complete and Enforced Architecture Needed for FAA Systems Modernization (GAO/AIMD-97-30, February 3, 1997); and Air Traffic Control: Improved Cost Information Needed to Make Billion Dollar Modernization Investment Decisions (GAO/AIMD-97-20, January 22, 1997).