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Foreign Military Sales: A Financial Analysis and Assessment of the Administrative Surcharge Rate

16 May 2011

by

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Major Abizer H. Tyabji, USAF

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ABSTRACT

This study addresses a request by the Defense Security Cooperation Agency (DSCA) to assess the foreign military sales (FMS) administrative surcharge rate and identify relevant cost drivers.

The DSCA operates on a no-profit, no-loss basis and recovers full costs by charging a surcharge rate against FMS values. In 2006, the DSCA increased the rate from 2.5% to 3.8% based on an internal Fees Study Group analysis. While their analysis was well-founded, FMS has more than doubled—inflating the trust fund balance and raising questions regarding the proper surcharge rate.

We recommend the DSCA lower its administrative surcharge rate from 3.8% to 3.0%. Historical models validate 3.0% as a sufficient rate when applied to actual data from 1999 to 2010. Monte Carlo FMS simulations demonstrate that 3.0% minimizes trust fund variation, while mitigating the risk of falling below safety levels or accruing an excessive balance.

Using parametric cost-estimating techniques, we tested six cost factors as explanatory variables to predict workload and budgets. Through regression analysis, we identified the number of letters of request (LORs) completed during the fiscal year as the most statistically significant cost driver. Additionally, the DSCA should monitor the rising trends in contractor support and total open cases.

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LIST OF ACRONYMS AND ABBREVIATIONS

AECA	Arms Export and Control Act
AFP	Annual Funding Program
AFSAC	Air Force Security Assistance Center
AOR	Area of Responsibility
BER	Budget Estimating Relationship
CER	Cost-Estimating Relationship
CMP	Comptroller
CWD	Case Writing Division
DAO	Defense Attaché Offices
DASA–DE&C	Deputy Assistant Secretary of the Army for Defense Exports and Cooperation
DBO	Business Operations Directorate, DSCA
DCMA	Defense Contract Management Agency
DFAS–IN	Defense Finance and Accounting Service–Indianapolis
DIILS	Defense Institute of International Legal Studies
DISAM	Defense Institute of Security Assistance Management
DLA	Defense Logistics Agency
DoD	Department of Defense
DoS	Department of State
DRI	Defense Reform Initiative
DSAA	Defense Security Assistance Agency
DSAMS	Defense Security Assistance Management System
DSCA	Defense Security Cooperation Agency
DTRA	Defense Threat Reduction Agency
FAA	Foreign Assistance Act
FMCS	Foreign Military Construction Services
FMFP	Foreign Military Financing Program
FMS	Foreign Military Sales
FMS–AA	Foreign Military Sales Trust Fund–Administrative Account
FMSA	Foreign Military Sales Act

FMSCR	Foreign Military Sales Credit
FPIO	Financial Policy and Internal Operations
FTE	Full-Time Equivalent
FY	Fiscal Year
GAO	General Accounting Office
GAO	Government Accountability Office
GCC	Geographic Combatant Commands
HDM	Human Assistance, Disaster Relief, and Mine Action
IA	Implementing Agency
IG	Inspector General
IMET	International Military Education and Training
IPO	International Programs Office
IT	Information Technology Directorate
JIC	Joint Inflation Calculator
LOA	Letter of Offer and Acceptance
LOAD	Letter of Offer and Acceptance Data
LOR	Letter of Request
LSC	Logistics Support Charge
MAD	Mean Absolute Deviation
MAE	Mean Absolute Error
MAP	Military Assistance Program
MAPE	Mean Absolute Percentage Error
MILDEP	Military Department
NAVICP–OF	Naval Inventory Control Point, International Programs Directorate
NCCA	Naval Center for Cost Analysis
NGA	National Geospatial–Intelligence Agency
NSA	National Security Agency
OA	Obligation Authority
OED	Offer Expiration Date
OMB	Office of Management and Budget
OPS	Operations Directorate, DSCA
OSD	Office of the Secretary of Defense

P&A	Price and Availability
PBGC	Pension Benefit Guaranty Corporation
PGM	Programs Directorate, DSCA
POM	Program Objective Memorandum
PPBE	Planning, Programming, Budgeting, and Execution
SAF/IA	Deputy Under Secretary of the Air Force for International Affairs
SAMM	*Security Assistance Management Manual*
SAO	Security Assistance Offices
SCML	Small Case Management Line
SCO	Security Cooperation Organization
SEE	Standard Error of the Estimate
SDO/DATT	Senior Defense Official/Defense Attaché
SLS	Standard Level of Service
SSC	Supply and Services Complete
STR	Strategy Directorate, DSCA
USASAC	United States Army Security Assistance Command
USG	United States Government
W/Y	Work Year

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I. INTRODUCTION

A. PURPOSE OF STUDY

In this study, we addressed a request by the director for business operations (DBO) at the Defense Security Cooperation Agency (DSCA) to assess the foreign military sales (FMS) administrative surcharge rate. The administrative surcharge rate is assessed against FMS to recover full costs incurred from administering the program. The DSCA established the current rate of 3.8% based on a 2005 internal analysis known as the Fees Study Group. The purpose of this study is to provide an assessment of the DSCA's cost structure, identify relevant cost drivers of implementing the FMS program, review the 2005 Fees Group analysis, and identify the best methodology for determining the administrative surcharge rate.

B. DSCA BACKGROUND

1. Mission and Organization

The DSCA is a United States Government (USG) defense agency that operates under the Office of the Secretary of Defense (OSD), as shown in Figure 1.

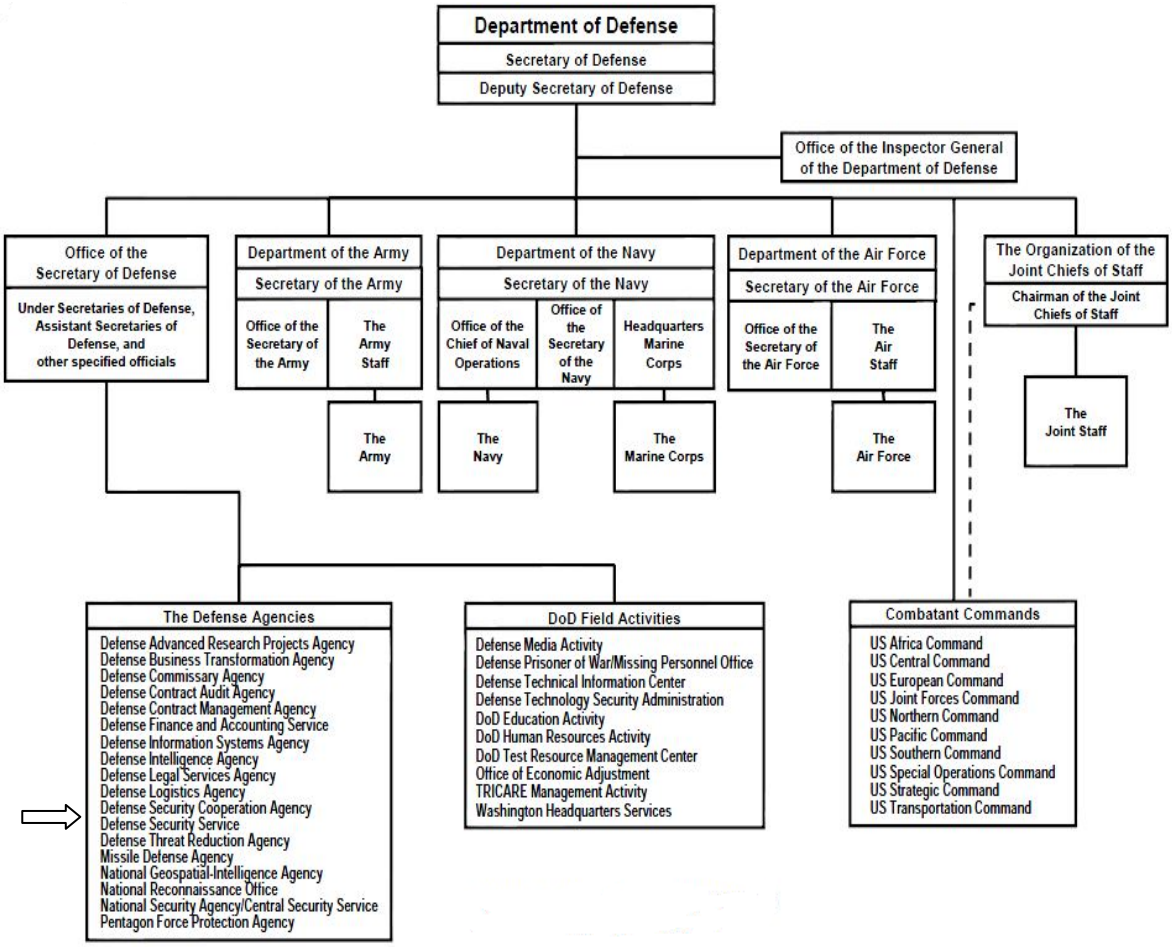

Figure 1. Department of Defense Organization Chart
(Office of the Secretary of Defense [OSD], 2010)

The DSCA is established as a separate Department of Defense (DoD) agency "under the direction, authority, and control of the Under Secretary of Defense for Policy and receives policy direction from the Assistant Secretary of Defense for Global Strategic Affairs" (Defense Institute of Security Assistance Management [DISAM], 2010, pp. 3–12). Figure 2 depicts the various defense agencies as shaded boxes.

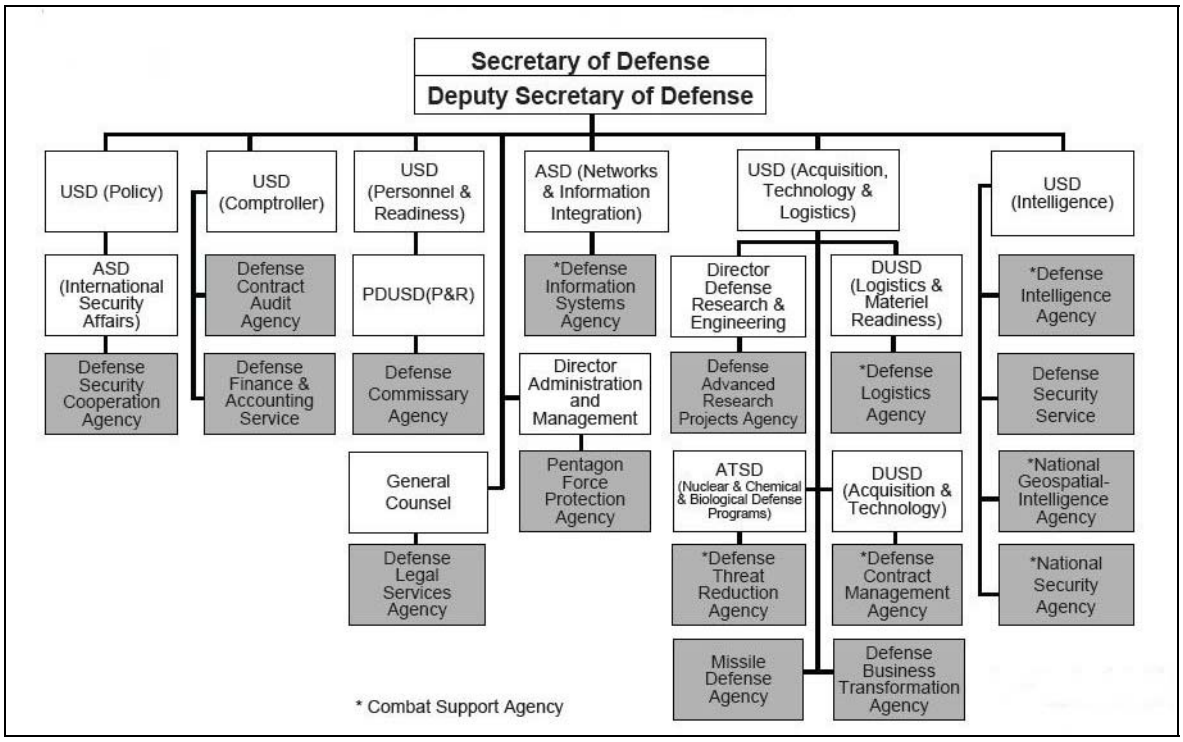

Figure 2. Defense Agencies
(OSD, 2008)

The mission of the DSCA is to "lead, resource, and educate the defense security cooperation community to shape, refine, and execute innovative security solutions for partners in support of U.S. interests" (Defense Security Cooperation Agency [DSCA], n.d.a). In accordance with DoD Directive 5105.65, the DSCA "shall direct, administer, and provide overall policy guidance for the execution of security cooperation and additional DoD programs" (Department of Defense [DoD], 2000, p. 2). The *Security Assistance Management Manual* (*SAMM*) further describes the DSCA as "the DoD focal point for government-to-government arms transfers, budget, legislative, projections, forecasting, and other security assistance matters" (DSCA, 2003, p. 45).

2. Security Assistance Programs

Security assistance is a group of programs that allows the USG to provide defense equipment, training, and services to friendly foreign nations. For instance, security assistance may include exporting arms to foreign governments, training international students in U.S. service schools, or advising allied militaries on how to improve internal

defense capabilities (DSCA, 2003, p. 35). Joint Publication 1-02 defines security assistance as the following:

> A group of programs authorized by the Foreign Assistance Act of 1961, as amended, and the Arms Export Control Act of 1976, as amended, or other related statutes by which the United States provides defense articles, military training, and other defense-related services by grant, loan, credit, or cash sales in furtherance of national policies and objectives. Security assistance is an element of security cooperation funded and authorized by Department of State to be administered by Department of Defense/Defense Security Cooperation Agency. (DoD, 2001, p. 415)

The premise behind security assistance is that "if these transfers are essential to the security and economic well-being of allied governments and international organizations, they are equally vital to the security and economic well-being of the United States" (DSCA, 2003, p. 35). According to the *SAMM,* security assistance programs "increase the ability of our friends and allies to deter and defend against possible aggression, promote the sharing of common defense burdens, and help foster regional stability" (DSCA, 2003, p. 35). In this way, the United States contributes to its own security and prosperity by helping other nations meet their defense and national security requirements.

The major security assistance programs are outlined in Table 1. Because these programs interact with foreign governments, the Department of State (DoS) maintains primary responsibility and general oversight of all security assistance programs as components of U.S. foreign assistance. However, the DoS delegates several of these programs to the DoD for management and execution. The DCSA administers the first seven programs listed in Table 1 for the DoD, which include the following: FMS; foreign military construction services (FMCS); the foreign military financing program (FMFP), formerly known as the foreign military sales credit (FMSCR); leases; the military assistance program (MAP); international military education and training (IMET); and drawdown.

Table 1. Major Types of Security Assistance Programs
(DSCA, 2003, p. 35)

	Type of Security Assistance Program	Administered by:
1	Foreign Military Sales (FMS)	DoD
2	Foreign Military Construction Services (FMCS)	DoD
3	Foreign Military Sales Credit (FMSCR)	DoD
4	Leases	DoD
5	Military Assistance Program (MAP)	DoD
6	International Military Education and Training (IMET)	DoD
7	Drawdown	DoD
8	Economic Support Fund	DoS
9	Peace Keeping Operations (PKO)	DoS
10	International Narcotics Control and Law Enforcement (INCLE)	DoS
11	Nonproliferation, Anti-Terrorism, Demining, and Related Programs (NADR)	DoS
12	Commercial Export Sales Licensed Under the Arms Export Control Act (AECA) of 1976, as amended (reference (c))	DoS

3. Security Assistance Legislation

Security assistance programs have their foundation in two basic laws: the Foreign Assistance Act of 1961 (FAA) and the Arms Export Control Act of 1976 (AECA). Together, the FAA and AECA provide the authority for all DSCA security assistance programs. The FAA serves as the authorizing legislation for a wide variety of foreign assistance programs, to include IMET, drawdown, the Economic Support Fund, and peacekeeping operations. The AECA provides the statutory basis for FMS, FMCS, FMFP, leases, and Direct Commercial Sales (DISAM, 2010). Upon signing AECA into law, President Gerald Ford stated that "this bill [AECA] recognizes that security assistance has been and remains a most important instrument of United States foreign policy" (The American Presidency Project, 1976). Figure 3 illustrates the development and relationships of the major security assistance acts.

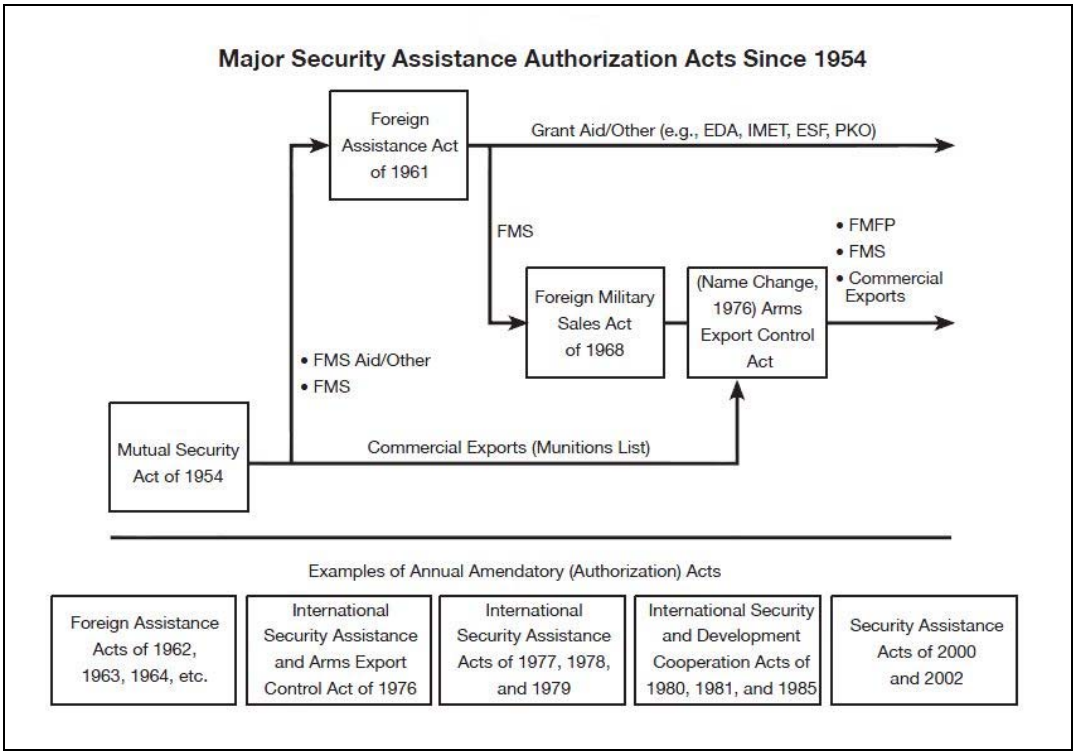

Figure 3. Major Security Assistance Authorization Acts
(DISAM, 2010, p. 2–2)

4. Security Cooperation

Security cooperation is a general term used for defense relationships with foreign governments that support U.S. national interests. Joint Publication 1-02 defines security cooperation as the following:

> All DoD interactions with foreign defense establishments to build defense relationships that promote specific U.S. security interests, develop allied and friendly military capabilities for self-defense and multinational operations, and provide U.S. forces with peacetime and contingency access to a host nation. (DoD, 2001, p. 416)

Secretary of Defense William S. Cohen first introduced the term *security cooperation* in his Defense Reform Initiative (DRI) of 1997. Prior to the DRI, the DSCA was known as the Defense Security Assistance Agency (DSAA) and primarily managed the major security assistance programs authorized by the FAA and the AECA. The DRI proposed that the DSAA assume responsibility for other DoD-funded international programs in addition to their traditional security assistance responsibilities. In 1998, the

DSAA was re-designated the Defense Security Cooperation Agency to reflect their larger mission beyond security assistance. With this expansion, the traditional security assistance programs became a subset of the broader security cooperation term (DISAM, 2010, p. 1–1).

In recent years, the DSCA has assumed management responsibilities for several DoD international programs under the umbrella of security cooperation. The Human Assistance, Disaster Relief, and Mine Action (HDM) programs were "the first DOD-funded programs to be administered by the DSCA under the new Security Cooperation term" (DISAM, 2010, p. 1–14). Since then, the DSCA has assumed responsibility for several other DoD-funded international programs, including the Warsaw Initiatives Fund, the Combating Terrorism Fellowship Program, and the Regional Centers for Security Studies (DISAM, 2010, p. 3–12). Despite the growth of the DSCA's responsibilities, the long-established security assistance programs, namely FMS, remain at the core of security cooperation.

5. The Major Players

The DSCA is the central agency that synchronizes security cooperation programs globally across the OSD, the Joint Staff, the DoS, Congress, geographic combatant commands (GCCs), military departments (MILDEPs), security cooperation organizations (SCOs), U.S. industry, foreign governments, and international organizations. The DSCA serves as the hub for most DoD security cooperation activities and serves as the DoD's primary interface with the DoS for security assistance programs (DSCA, n.d.d). Figure 4 illustrates the various organizations that interface with the DSCA.

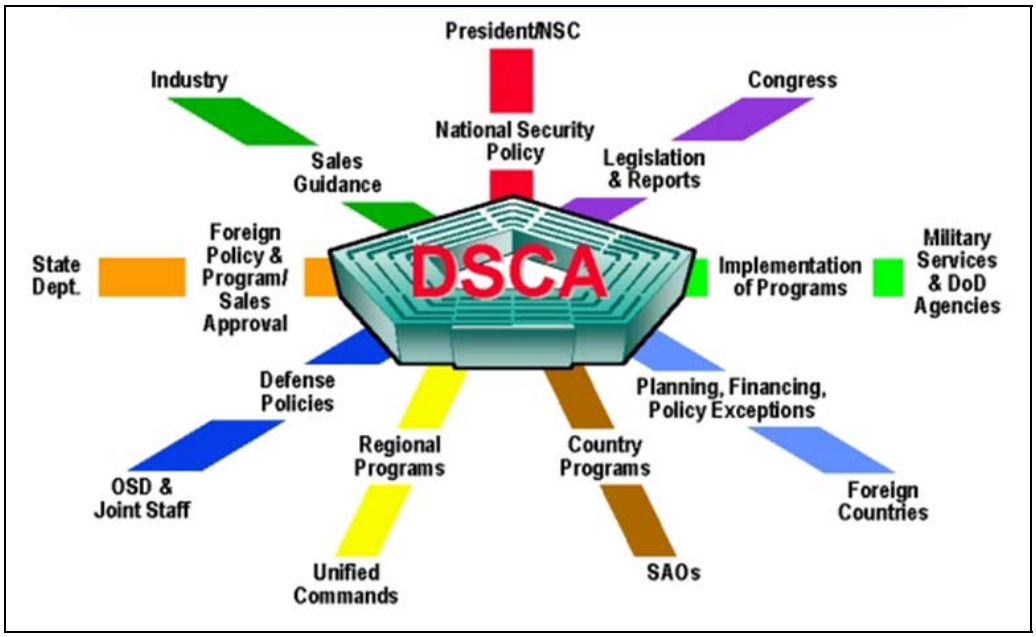

Figure 4. DSCA Interface with Organizations
(DSCA, n.d.d)

The three major USG organizations involved with security cooperation programs are Congress, the DoS, and the DoD. The responsibilities of each of these players are described in DoD 5105.38-M:

(1) Congress "authorizes programs and appropriates funds for the USG-financed portions of security assistance… and oversees the sale of defense articles and services to foreign countries and international organizations" (DSCA, 2003, p. 45).

(2) The DoS is "responsible for the continuous supervision and general direction of the security assistance program" (DSCA, 2003, p. 45). This includes determining which countries are eligible, determining the size and scope of their program, and issuing commercial export licenses for direct commercial sales.

(3) The DoD "establishes military requirements and implements programs to transfer defense articles and services to eligible foreign countries and international organizations" (DSCA, 2003, p. 45). The DoD executes the security assistance programs delegated from the DoS, determines what is available for sale or lease, and manages all aspects of logistical support. The DoD also oversees and executes the security cooperation programs authorized under Title 10 and provides extensive input on security cooperation policy (DSCA, 2003).

While Congress and the DoS provide direction and oversight for security cooperation programs, the three MILDEPs and other implementing agencies (IA) actually execute the programs. MILDEPs and other IAs "prepare and execute FMS cases to provide defense articles and services" (DSCA, 2003, p. 46) to our foreign partners. Each of the three major military Services manages their own respective security assistance organizations.

- Army. The deputy assistant secretary of the Army for defense exports and cooperation (DASA–DE&C) is responsible for the Army's role in security assistance, armaments cooperation, and other programs. However, the Army FMS program is managed separately by the Army security assistance command (USASAC).
- Navy. The Navy International Programs Office (IPO) has overall responsibility for Navy, Marine Corps, and Coast Guard security assistance and cooperative programs. The Naval Inventory Control Point, International Programs Directorate (NAVICP–OF) provides initial and follow-on logistics support to partner nations.
- Air Force. The Deputy Under Secretary of the Air Force for International Affairs (SAF/IA) serves as the lead agency for all security cooperation programs. It is supported by the Air Force Security Assistance Center (AFSAC) for most FMS and other logistics functions.
- Other IAs include the National Security Agency (NSA), the National Geospatial-Intelligence Agency (NGA), the Defense Contract Management Agency (DCMA), the Defense Logistics Agency (DLA), and the Defense Threat Reduction Agency (DTRA; DISAM, n.d.).

The DSCA interacts with multiple other parties to foster security cooperation programs throughout the world. This includes coordinating with the GCCs, security cooperation organizations (SCOs) and Defense Attaché Offices (DAO). Security cooperation is largely conducted through lateral coordination across various agencies as shown in Figure 5 (DISAM, n.d.). While this lateral coordination typically expedites program planning and execution, it can also be a source of friction among organizations vying for resources.

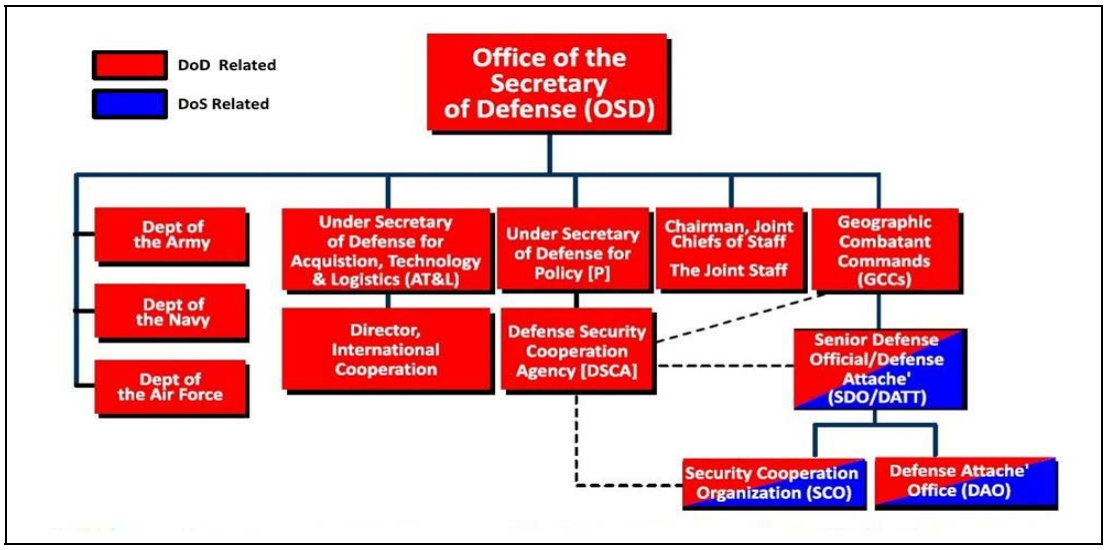

Figure 5. DSCA Lateral Coordination
(DISAM, n.d.)

The six GCCs have responsibility for overseeing and executing security cooperation programs with foreign nations in their respective areas of responsibility (AORs). GCCs develop theater campaign plans that prioritize security cooperation programs to shape their regions. GCCs typically interact with their foreign partners through their assigned SCO (DISAM, n.d.).

The generic term *SCO* refers to "all DoD elements, regardless of actual title, located in a foreign country to carry out security assistance management functions under the FAA and the AECA" (DSCA, 2003, p. 50). SCOs are normally co-located with the American embassy and serve as the primary interface between the foreign governments and DoD organizations for security cooperation matters. SCO functions include management and oversight of security assistance programs, general advisory and training assistance to the host country, and administrative support (DSCA, 2003, p. 50). Each SCO is headed by a senior defense official/defense attaché (SDO/DATT), who is the senior DoD representative to the U.S. ambassador and to the foreign government's military (DISAM, n.d.).

6. DSCA Directorate

The DSCA is headquartered in Arlington, VA, and is organized into directorates headed by principal directors. These directorates include business operations (DBO),

information technology (IT), operations (OPS), programs (PGM), strategy (STR), DISAM, and the Defense Institute of International Legal Studies (DIILS). The DSCA also administers five regional centers for security studies that provide education, research, and outreach to allied and partnered nations to promote peace and stability through security cooperation (DSCA, n.d.f). Figure 6 outlines the DSCA directorates with their underlying divisions and functional areas.

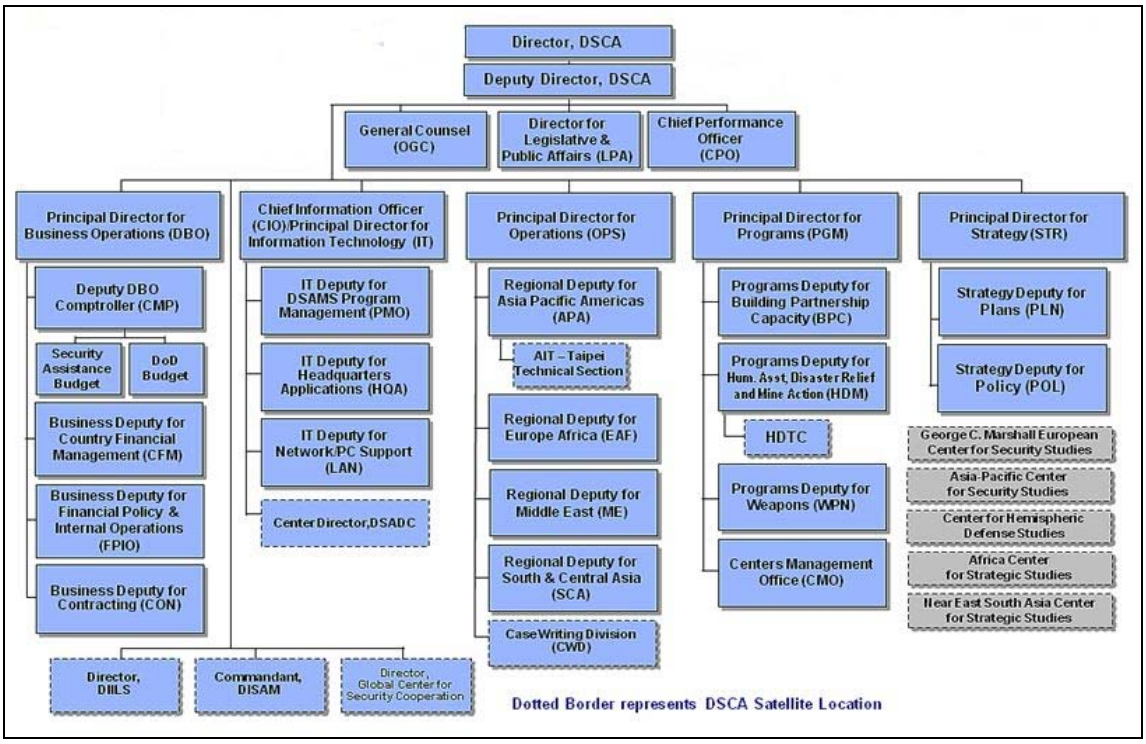

Figure 6. DSCA Organization Chart
(DSCA, 2010a)

7. DSCA Trust Fund Management

The DSCA has three main departments that administer the surcharge rate as well as the FMS trust fund. These departments are comptroller (CMP), financial policy and internal operations (FPIO), and strategy (STR). FPIO is the lead organization in determining the administrative surcharge rate as well as in managing the health of the FMS trust fund–administrative account (FMS–AA; DSCA, personal communication, January 5–7, 2011). In the next section we describe each organization's relationship to the FMS trust fund.

a. Comptroller

The comptroller office is headed by the deputy DBO comptroller (CMP), who reports to the DBO. The mission of this office is multi-faceted; however, it has several specific functions that pertain to the administrative surcharge rate. First, the CMP handles the day-to-day accounting of the FMS trust fund, including deposits, withdrawals, and transfers. Secondly, the CMP interfaces with MILDEPs to receive program objective memorandums (POMs). POMs are the mechanism for MILDEP funding requests. MILDEP funding requests are then vetted and approved through the DSCA organization. Finally, the CMP allocates funds to the MILDEPs to execute their FMS programs (DSCA, personal communication, January 5–7, 2011).

The CMP produces expense data that is used by FPIO to plan FMS trust fund projections. Expense data is driven by MILDEP POM requests and is forecasted out two years. All expense data is calculated by using future budget projections, and historical data is not taken into account. Currently, the CMP only uses POM requests to make expense projections and does not employ other metrics, such as utilizing DFAS data (DSCA, personal communication, January 5–7, 2011).

b. Strategy

The STR office develops FMS forecast data for the FMS trust fund. Due to the unpredictability of FMS, STR can only predict with a degree of certainty two years out. Beyond that, the variability in the data induces large uncertainty in the forecasts. Current FMS prediction models utilize linear regression and moving averages (DSCA, personal communication, January 5–7, 2011).

c. FPIO

FPIO is the heart of the DSCA for managing the health and well-being of the FMS–AA. FPIO uses POM numbers supplied from the CMP as well as FMS forecasts from STR to determine projected FMS–AA health. Expense models usually project for three years while FMS project for two. In order to project beyond those years, FPIO uses models that assume either constant expenses or FMS. FPIO conducts an

annual assessment of the administrative surcharge rate by reviewing the projected status of the FMS–AA (DSCA, personal communication, January 5–7, 2011).

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II. DESCRIPTION AND HISTORY OF FMS

A. PROGRAM DESCRIPTION

1. FMS Overview

According to DoD 5105.38-M, FMS is "that part of security assistance authorized by the AECA and conducted using formal contracts or agreements between the USG and an authorized foreign purchaser" (DSCA, 2003, p. 95). The FMS program brochure explains the following:

> Under FMS, the U.S. government procures defense articles and services on behalf of the foreign customer. Countries approved to participate in this program may obtain defense articles and services by paying with their own national funds or with funds provided through U.S. government-sponsored assistance programs. In certain cases, defense articles, services and training may be obtained on a grant basis. (DSCA, n.d.b)

Simply put, the FMS program is "the government-to-government method for selling U.S. defense equipment, services, and training" to foreign allies (DSCA, n.d.c). FMS is the largest of all U.S. security cooperation programs administered by the DSCA and is a fundamental U.S. foreign policy tool. The stated purpose is that "the FMS program supports U.S. foreign policy and national security objectives" (DSCA, 2003, p. 95). The program maintains the following:

> Responsible arms sales further national security and foreign policy objectives by strengthening bilateral defense relations, supporting coalition building, and enhancing interoperability between U.S. forces and militaries of friends and allies. These sales also contribute to American prosperity by improving the U.S. balance of trade position, sustaining highly skilled jobs in the defense industrial base, and extending production lines and lowering unit costs for key weapon systems. (DSCA, n.d.c)

By law, the "FMS program must be administered at no cost to the United States Government" (Government Accountability Office [GAO], 2009, p. 4). According to the DSCA, "FMS is managed and operated by DoD on a no-profit and no-loss basis. Countries and international organizations participating in the program pay for defense articles and services at prices that recoup the actual costs incurred by the United States" (DSCA, n.d.e). The DSCA applies an administrative surcharge to each FMS contract to

recover the full costs of administering the program. The administrative surcharge rate is currently 3.8% applied to the value of each sale (Baker, 2006).

In recent years, FMS agreements have reached record levels, topping $38 billion in 2009. The large growth in FMS has raised questions regarding the application of the administrative surcharge rate and the allocation and use of funds (GAO, 2009, p. 16). Figure 7 shows the 40-year history of total FMS agreements worldwide from 1972 to 2010.

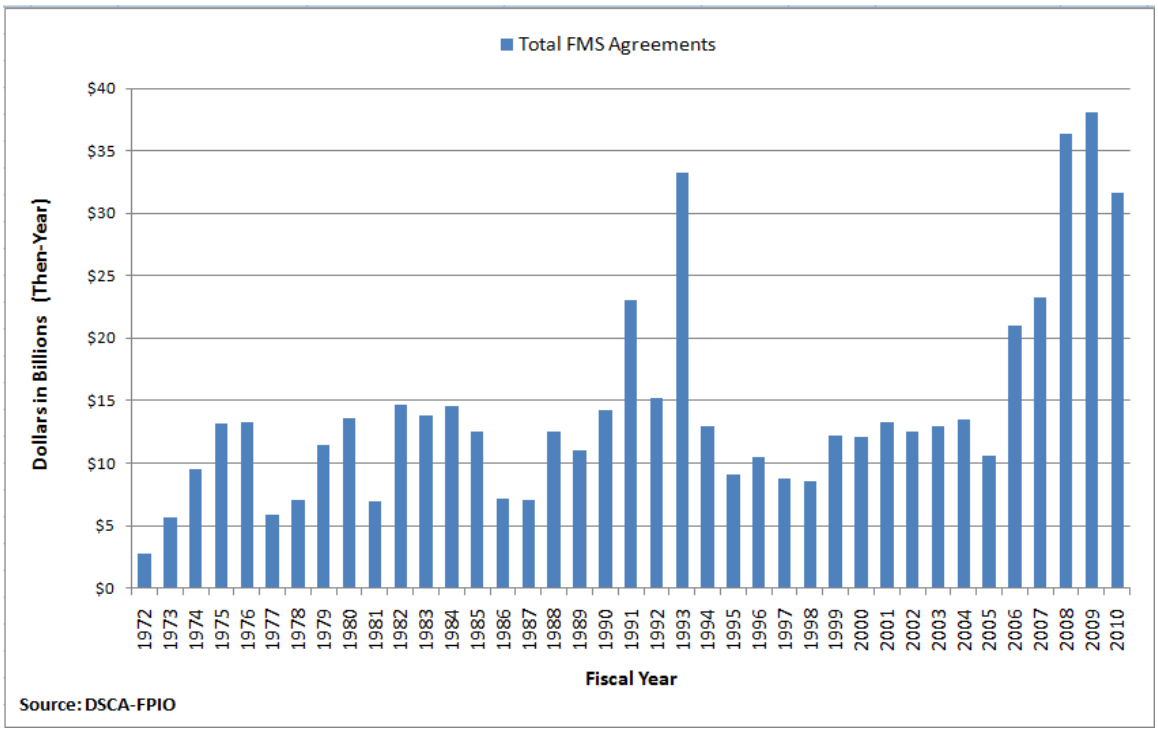


Figure 7. Total Worldwide FMS Agreements (1972–2010)
(DSCA, 2011)

Examining foreign military sales as a proportion of total U.S. military spending provides a more relevant measure of program growth. Figure 8 depicts FMS agreements as a percentage of the total U.S. defense outlays from 1972 to 2010. At its peak in 1975, FMS agreements represented over 15% of total military spending, but the percentage declined rapidly over the next decade to below 5% throughout the late 1980s. However, in 1993, the share of FMS spiked to nearly 12%. The increase in FMS agreements from 1991 to 1993 can be attributed to "new orders for U.S. arms in the Persian Gulf" as a result of "frenetic marketing activity" and the Gulf War (Hartung, 1999, p. 178). Since

then, FMS agreements have stabilized to between 2% and 6% of total U.S. military defense spending despite significant growth of actual FMS dollar amounts in recent years.

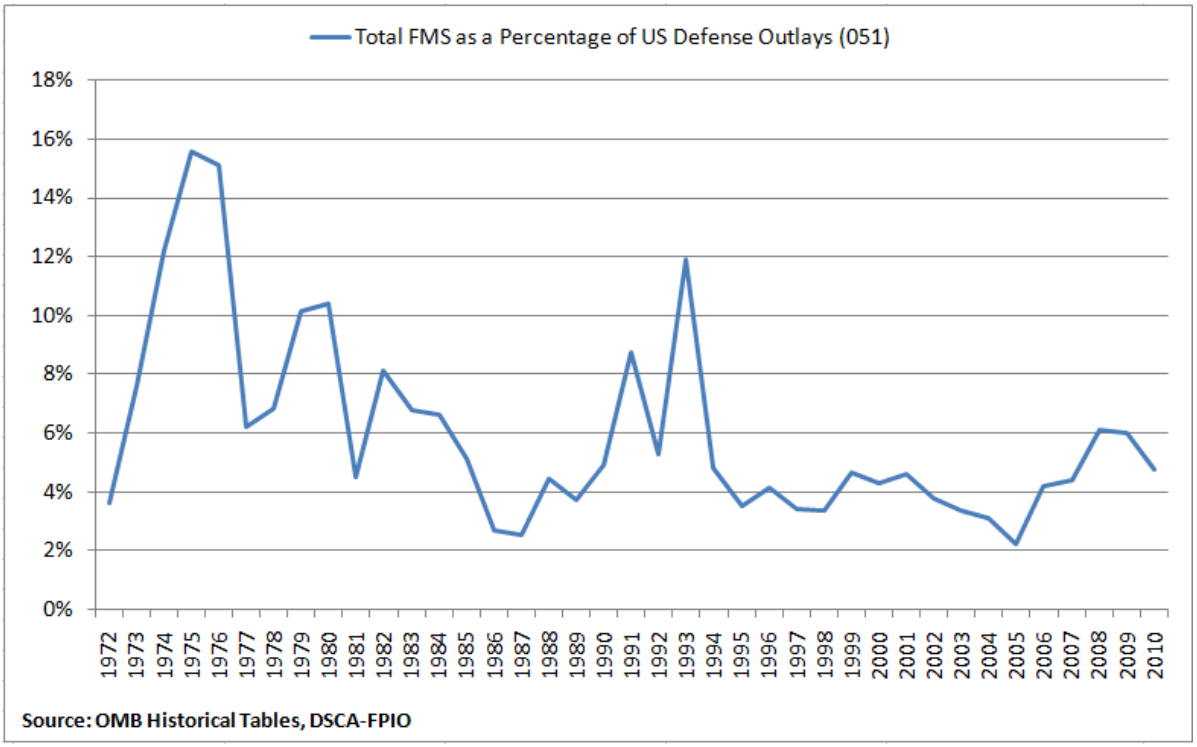


Figure 8. FMS as a Percentage of U.S. Defense Outlays (1972-2010)
(DSCA, 2011; Office of Management and Budget [OMB], 2010a)

2. FMS Case Process

The Management of Security Assistance, published by DISAM, outlines the FMS case process in six phases. The following is a summary description of each phase, with selected excerpts taken from both *The Management of Security Assistance* and the *SAMM*.

a. Preliminary

The FMS process begins when "an eligible foreign country or international organization requests information on defense articles or services being considered for purchase" (DSCA, 2003, p. 125). The customer identifies a potential defense need to meet its own national security requirements and obtains specific systems information from the USG. Normally, the customer will be engaged in ongoing

consultations with the in-country SCO or another U.S. representative (DSCA, 2003, p. 125).

b. Request

The customer prepares and submits a letter of request (LOR). Although there is no standard format required for an LOR, the LOR "shall identify the desired defense articles and/or services in sufficient detail for the USG to prepare an accurate cost estimate" (DSCA, 2003, p. 125). LORs are routed through the U.S. Embassy to the appropriate MILDEP or IA for action. The "IA is the USG organization authorized to receive and process LORs" (DISAM, 2010, p. 5–3). Figure 9 illustrates the channels of request for the LOR.

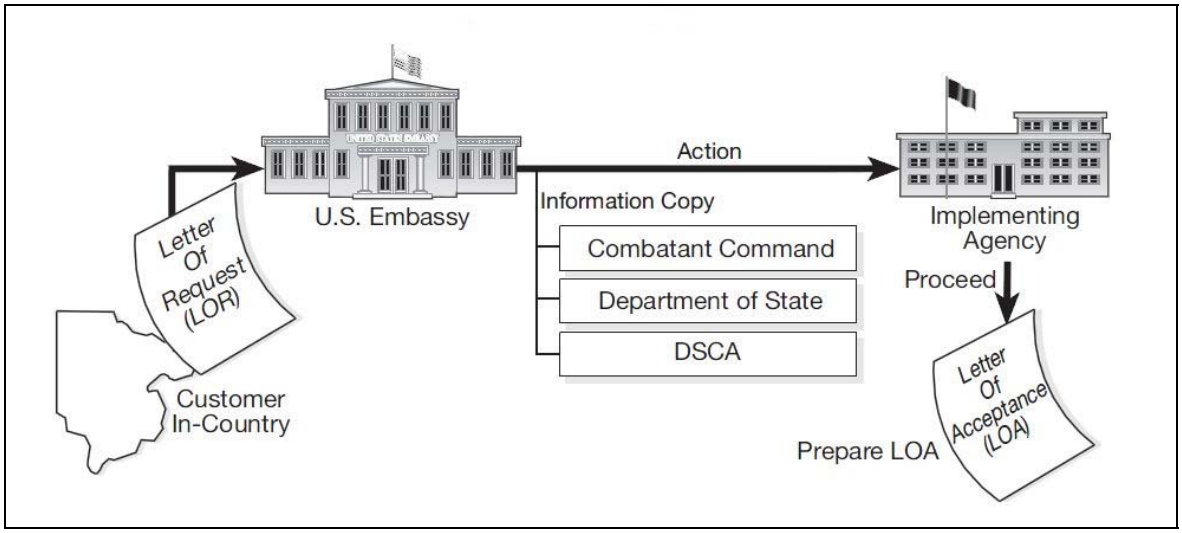


Figure 9. Channels of Request
(DISAM, 2010, p. 5–4)

c. Development of Offer

This phase begins once the IA receives an LOR from a partner nation and ends with a formal offer to the customer through a Letter of Offer and Acceptance (LOA). Upon receipt of the LOR, the IA confirms whether the requestor is eligible. In accordance with the AECA, "defense articles and/or services may be sold or leased to a country or international organization only if the President makes a determination that the prospective purchaser is eligible" (DSCA, 2003, p. 95). Table 2 summarizes the AECA criteria for eligibility.

Table 2. Presidential Determination Criteria for FMS Eligibility
(DSCA, 2003, p. 95)

	FMS Eligibility Criteria
1	The furnishing of defense articles and defense services to such country or international organization strengthens the security of the United States and promote world peace;
2	The country or international organization shall have agreed not to transfer title to, or possession of, any defense article or related training or other defense service so furnished to it or produced in a cooperative project, to anyone not an officer, employee, or agent of that country or international organization, and not to use or permit the use of such an article or related training or other defense service for purposes other than those for which furnished unless the consent of the President has first been obtained;
3	The country or international organization shall have agreed that it shall maintain the security of such article or service and provide substantially the same degree of security protection afforded to such article by the United States; and
4	The country or international organization is otherwise eligible to purchase or lease defense articles or defense services.

Once eligibility is validated, the IA acknowledges receipt of the LOR by assigning a unique case identifier within 5 days. Within 10 days, the IA should enter case information into the Defense Security Assistance Management System (DSAMS) database and provide congressional notification, if required (DISAM, 2010, p. 5–7). The following are the two main response documents to an LOR:

(1) Price and Availability (P&A). A P&A response "is provided for country planning purposes only and shows estimated costs and projected availability of defense articles or services" (DISAM, 2010, p. 5–6). It is important to note that a P&A does not constitute USG approval or commitment to sell. The IA should provide a P&A response within 45 days after receiving the LOR.

(2) Letter of Offer and Acceptance. The LOA "is the authorized document used by the USG as an offer to sell defense articles and services to a foreign country of international organization" (DISAM, 2010, p. 5–6). The IA assigns a case manager to each LOA to manage all aspects of the FMS case, including the compilation of LOA data (LOAD) and coordination with program managers. Concurrent with LOA preparation, the DSCA obtains approval from the DoS and prepares a notification package for Congress. After the LOAD is complete, the IA submits the LOA to the DSCA Case Writing Division (CWD) for final review and policy compliance. The CWD then countersigns the LOA and returns it to the IA. Finally, the IA signs and forwards

the approved LOA to the customer for acceptance. Although the time required to complete an LOA varies with each sale, the general directive is to "provide the customer an LOA within 120 days for 80% of all LORs" (DISAM, 2010, p. 5–6).

d. Acceptance of the Offer

This phase begins once the IA presents the LOA to the customer and ends when the customer officially accepts the offer. The customer should accept the offer by the offer expiration date (OED), as specified on the LOA. Generally, the OED is 85 days, which includes 25 days for administrative processing and 60 days for country review. However, there are exceptions to this rule, and countries may request extensions or be given a short OED based on USG requirements (DSCA, 2003, p. 162). The LOA is accepted and becomes an official agreement once the customer both signs the LOA and provides the initial deposit to the Defense Finance and Accounting Service–Indianapolis (DFAS–IN; DSCA, 2003, p. 238). Once signed, the LOA and its subsequent amendments are referred to as an "FMS Case" and become a government-to-government agreement between the foreign government and the USG (DSCA, 2003, p. 238).

e. Implementation and Execution

The implementation phase begins once the LOA is accepted and should be accomplished within 15 days. Once DFAS–IN receives the initial deposit, they will issue obligation authority (OA) to the IA, which allows the case manager to begin case implementation. The IA will issue a case directive that provides detailed instructions and information for the FMS case (DISAM, 2010, p. 5–13).

Case execution is "usually the longest phase of the FMS case life cycle" and can take several years (DSCA, 2003, p. 259). Execution begins "when the IAs start the requisition and procurement process against the case directive and does not end until the last article or service is delivered or completed" (DISAM, 2010, p. 5–13). Case execution includes "logistics, acquisition, supply, transportation, maintenance, training, financial management, case management, oversight, coordination, case documentation, case amendment or modification, case reconciliation and case reporting" (DSCA, 2003, p. 259).

f. Reconciliation and Closure

This phase marks the final stages of the FMS life cycle. Reconciliation refers to the "financial and logistical actions that ensure proper accounting, accuracy, and thoroughness of data; currency of schedules; and timeliness and completeness of reporting" (DoD, 2004, p. 16). Reconciliation practices begin at implementation and continue as an iterative process throughout the FMS life cycle through closure. At a minimum, case managers should reconcile each case annually. A case is considered for closure once it meets criteria as supply and services complete (SSC). SSC status is achieved once "all materials are delivered, all services performed, all supply discrepancy reports resolved, all warranty periods elapsed, and all requirements of the LOA have been met" (DISAM, 2010, p. 5–19). After the case becomes SSC, the IA will submit a certificate of case closure to DFAS–IN (DISAM, 2010, p. 5–20). The FMS case is "considered closed when DFAS–IN issues a final bill or a final statement of account to the customer" (DISAM, 2010, p. 5–20).

B. THE FMS TRUST FUND ADMINISTRATION ACCOUNT

The DSCA manages financial resources for the FMS program through the FMS trust fund. The FMS trust fund is divided into two separate accounts: the case management account and the FMS-administrative account (FMS–AA). The case management account handles case requirements, with subaccounts tied to specific countries and cases. The FMS–AA, however, is a general deposit account. Once money has been deposited into the FMS–AA, it no longer retains its origins but is available to cover expenses for any administrative function. These expenses include salaries, travel, equipment, and rent. The FMS–AA is similar to a personal savings account: Money is available for use regardless of where the money originally came from. Figure 10 gives an overview of income and expenditures of the FMS trust fund in FY2010 (DSCA, personal communication, January 5–7, 2011).

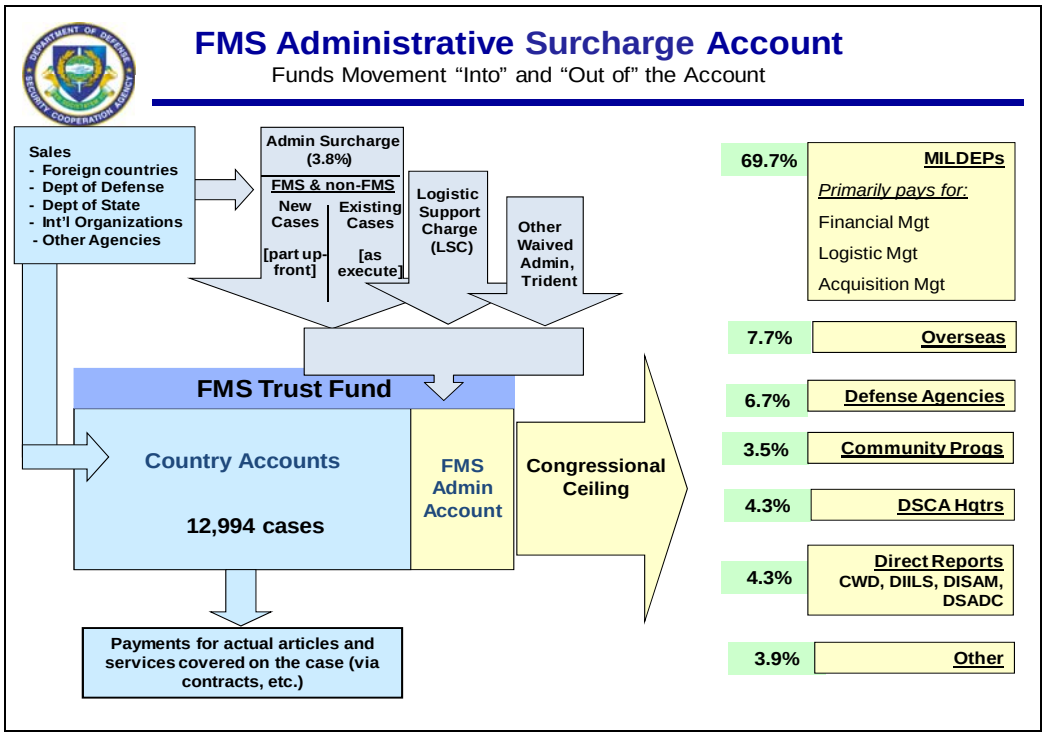
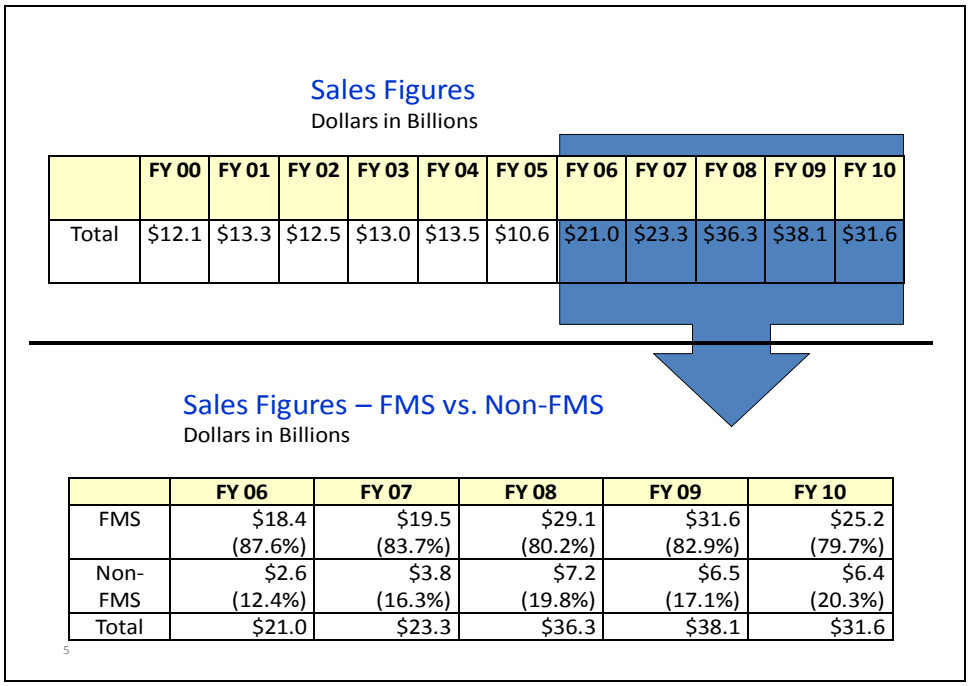


Figure 10. FY2010 FMS Trust Fund Overview
(Baker, 2010a, p. 4)

There are two main sources of income for the FMS–AA: FMS and non-FMS. All FMS sales are charged a 3.8% administrative surcharge fee, with 50% collected up front and the next 50% collected on a case-by-case time line. Non-FMS cases involve domestic orders, the two most common being the Iraq Security Forces Fund and the Afghanistan Security Forces Fund. These cases are also charged 3.8%, with 100% of the funds collected up front. Whereas the number of non-FMS cases has grown due to recent contingency operations, it remains less than 20% of the total FMS–AA income. Figure 11 displays the breakdown of FMS versus non-FMS sales. This data was supplied by the DSCA and is not normalized (DSCA, personal communication, January 5–7, 2011).



	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09	FY 10
Total	$12.1	$13.3	$12.5	$13.0	$13.5	$10.6	$21.0	$23.3	$36.3	$38.1	$31.6

	FY 06	FY 07	FY 08	FY 09	FY 10
FMS	$18.4 (87.6%)	$19.5 (83.7%)	$29.1 (80.2%)	$31.6 (82.9%)	$25.2 (79.7%)
Non-FMS	$2.6 (12.4%)	$3.8 (16.3%)	$7.2 (19.8%)	$6.5 (17.1%)	$6.4 (20.3%)
Total	$21.0	$23.3	$36.3	$38.1	$31.6

Figure 11. FMS Sales Breakdown
(Baker, 2010b, p. 5)

The FMS–AA has a safety level that is calculated from a criterion set forth in DoD 7000.14-R, Volume 15, Chapter 2 (Financial Management Regulation). The safety level is a calculated amount that assumes if all sales were to end, FMS–AA levels ensure current cases could be closed out within the next two years. The current safety level is $734 million. The DSCA aims to ensure a healthy balance that covers current costs plus the safety level. Figure 12 shows the FMS–AA balance from 2000 through 2010 (DSCA, personal communication, January 5–7, 2011).

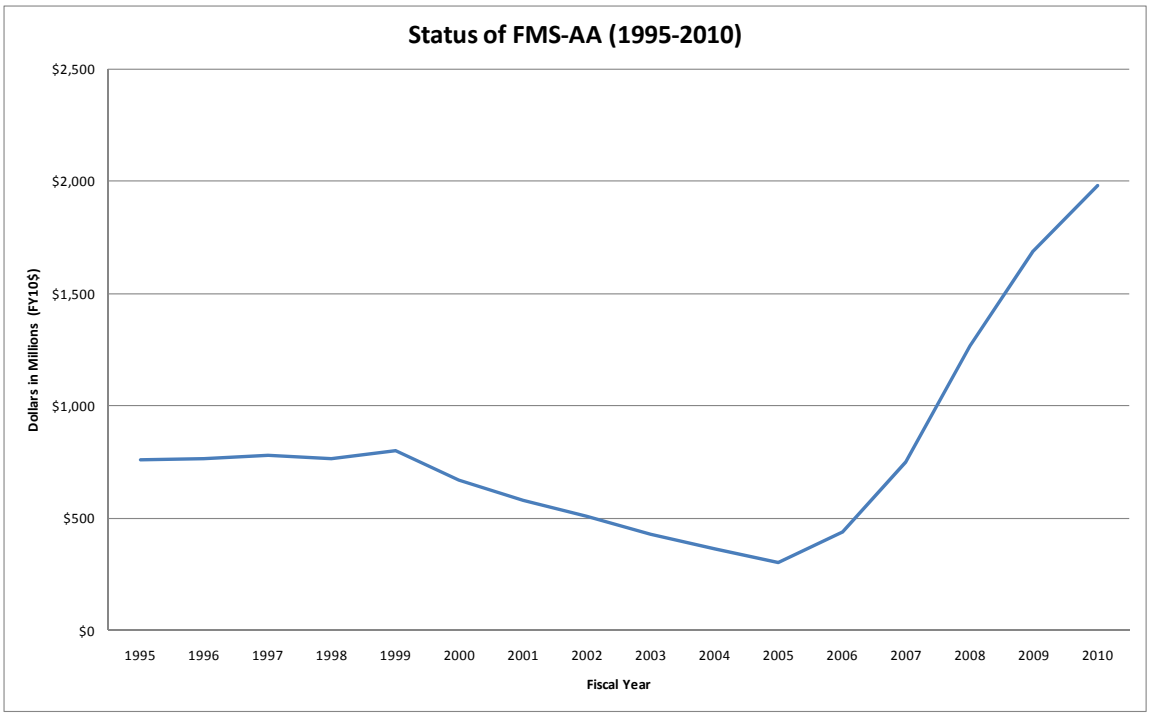


Figure 12. FMS–AA Balance for 1995-2010
(DSCA, 2011)

Because of a strong increase in sales from 2005 to 2010, the balance of FMS–AA reached a record $2 billion at the close of 2010. This balance raised interest in an organization that operates on a no-profit, no-loss basis (DSCA, personal communication, January 5–7, 2011).

1. History of the FMS Surcharge Rate

The FMS surcharge rate has changed three times in the past 40 years and is reviewed annually by the DSCA. The DSCA is similar to a working capital fund in that both organizations have the goal of breaking even. The difference between these two organizations is that a working capital fund changes their surcharge rates every year based on predicted sales and market conditions. The DSCA has expressed a reluctance to change their surcharge rates frequently. The first reason is that purchasing countries prefer the stability of a constant rate, and a changing surcharge rate would disrupt the decision-making processes of countries looking to invest in American military products. Secondly, because cases last an average of seven years, a constantly changing surcharge

rate would complicate case management (DSCA, personal communication, January 5–7, 2011).

The first significant issue with the FMS–AA came in 1984–1990, when FMS–AA balances were negative. In order to promote expense control, MILDEP budgets were reduced by 20% from 1986 through 1987. In 1987, the logistics support charge (LSC) was implemented, bringing in approximately $40 million a year; however, it was strongly disliked by customers because the charges were inconsistent. Finally, in 1990, the Fair Pricing Initiative promoted FMS by charging countries only incremental costs to the DoD for U.S. military sales. A positive by-product of this initiative was savings to the DSCA of $60 million a year because the DSCA was no longer responsible for reimbursing MILDEPs for military salaries associated with program administration (*Military Assistance Requirements*, 1989).

These savings, coupled with steady FMS, led to an FMS–AA balance of $540 million in 1999, an all-time high at that time for the FMS–AA. The DSCA leadership made a decision to reduce the administrative surcharge rate to 2.5% in order to reduce the balance of the FMS–AA. This decision was prompted by three factors: the high balance of the FMS–AA, a belief that previous cost savings would continue, and an idea that this move would generate goodwill in the international community. While the rate was reduced, the predicted savings did not happen. Budgets to MILDEPs that were supposed to be reduced actually increased, business reinvention methods did not produce significant savings, and revenue/expense levels were not as positive as predicted (Webster, 2005).

These factors prompted the DSCA to conduct an internal analysis in 2005. The outcome of this study was the decision to raise the administrative surcharge rate to 3.8%. The primary driver for this change is shown in Figure 13.

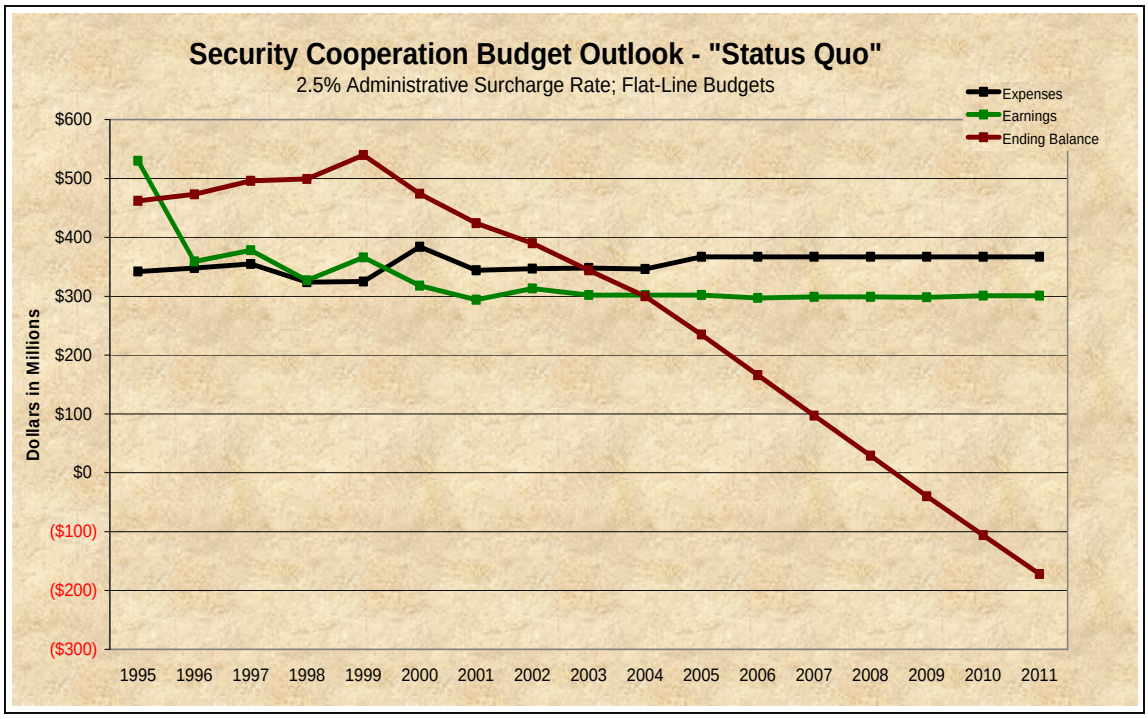


Figure 13. Predicted Trust Fund Balance From the 2005 Fees Study Group
(Baker, 2005a)

Based on projected revenue and expense levels, the DSCA determined that if no actions were taken, the FMS–AA would become insolvent in 2009. The DSCA's internal study focused on the following:

- reviewing past case files to understand the relationship between the administrative charge and the LSC;
- analyzing revenues generated by country, case size, MILDEP, and fiscal year;
- using statistical models to predict future revenues; and
- running several *what-if* scenarios of different solutions to forecast future FMS–AA health levels.

The decisions resulting from this study included increasing the surcharge rate to 3.8%, implementing a standard level of service (SLS), creating a small case management line (SCML), and eliminating the LSC. The SLS gives a guaranteed level of commitment and service to each purchasing country and answers the question from a buyer: What am I getting for my money? The DSCA also ended the practice of charging an LSC, which was subsequently covered by the new administrative rate. The LSC was very unpopular

with buying countries because the charge was not fixed. There was also a concern that raising the surcharge rate would cause countries not to buy from America because of the added expense, but record-setting FMS from 2006 to 2010 disproved this concern (DSCA, personal communication, January 5–7, 2011). Table 3 shows the changes in the administrative surcharge rate from 1977 to 2006. We conducted a brief analysis of this internal study in Chapter IV.

Table 3. History of the FMS Surcharge Rate
(Baker, 2010a, pp. 1–2)

History of the FMS Surcharge Rate	
Year	**Rate**
1977	3.0
1999	2.5
2006	3.8

2. DSCA Expenses

A current concern in the DSCA is the lack of transparency of expense data that is received from MILDEPs in their yearly POM request. The 3.8% surcharge rate was established to recover the full cost of administering the FMS program, but the problem is that actual case administrative costs are not currently verifiable. After a case has been accepted, it is managed by the implementing agencies—primarily at the MILDEP level. During the yearly POM request cycle, each MILDEP submits a budget request to cover total administrative expenses associated with executing all of their respective cases. Submitted expenses, however, are not linked to specific cases. There are no systems that track actual costs to individual cases, although attempts have been made in the past without success (DSCA, personal communication, January 5–7, 2011).

In 2001, the director of the DSCA required each MILDEP to use performance-based costing on all of their cases, thereby allowing cases to be tracked with associated expenses (Davis, 2002/2003). This program had a short life span because performance-based costing was too time consuming for MILDEP implementation. DSCA current practices rely upon MILDEP POM requests to forecast future expenses (DSCA, personal communication, January 5–7, 2011).

Another issue concerning transparency involves the SCMLs, which are cases that generated administrative fees of less than $15,000. The DSCA's internal study found that it takes a minimum of $15,000 to write, implement, and close an FMS case. In order to encourage buying countries to consolidate smaller cases to minimize the administrative workload, the DSCA required a minimum administrative cost of $15,000. Because each case is not linked with specific expense data, it is currently not possible to verify if $15,000 is the correct number, or if SCML cases need an adjustment factor (DSCA, personal communication, January 5–7, 2011).

C. THIRD-PARTY REPORTS CONCERNING THE DSCA

Three major government reports have been published concerning the DSCA in the past eleven years, two by the Government Accountability Office (GAO) and one by the Inspector General (IG) of the DoD. The earlier GAO report was published in 1999, and the more recent GAO and IG reports were published in 2009. Each report described three conclusions that were similar in nature.

The first conclusion of the reports was that

> the Department of Defense does not have sufficient information to determine the administrative costs associated with the Foreign Military Sales program. As a result, the Department is unable to use actual cost as a basis to determine what charges should be applied to foreign military sales, and does not know if the percentage charged to the customer on the dollar value of individual sales is appropriately recovering Foreign Military Sales program costs. (GAO, 1999b, p. 3)

All three reports cited the lack of transparent expense data, suggesting that an appropriate administrative surcharge rate is not verifiable.

The second conclusion was that the "DoD lacks information to oversee the program [FMS], in large part due to the fact that FMS data reside in 13 different accounting, financial, and case implementation systems" (GAO, 2009, p. 2). All MILDEPs use a different accounting and case management system, which leads to the DSCA not being able to track case expenses accurately. The GAO stated that

> to improve the administration and oversight of the FMS program, we recommend that the Secretary of Defense direct the Under Secretary of Defense for Policy to

> better determine the administrative costs of implementing the FMS program and develop metrics that allow the DSCA to comprehensively assess the performance of the FMS program. (GAO, 2009, p. 21)

Finally, the last conclusion was that the

> DSCA improperly collected administrative fees on Iraq and Afghanistan cases funding contingency operations. From FY2005 through FY2007, the DSCA collected more than $155 million in administrative fees to manage non-FMS cases for the ISSF and the ASFF processed in the FMS Trust fund. It is DSCA policy, based on the DoD FMR, not to collect administrative expenses on funds placed in the FMS Trust fund for contingency operations. Because ISFF and ASFF are funding contingency operations, the DSCA should not collect administrative fees on these cases. (DoDIG, 2009, p. i)

The DSCA director did not concur with this finding, stating that "DSCA met all requirements of the Economy Act, and that DSCA is required to collect all the direct and indirect costs of the planned work" (DoDIG, 2009, p. i).

D. DSCA BUSINESS PRACTICES COMPARISON

While the DSCA's business model is uncommon, the Pension Benefit Guaranty Corporation (PBGC) shares qualities in their operations that are similar to the DSCA. Below is a brief comparison of the PBGC to the DSCA.

Congress established the PBGC by passing the 1974 Employee Retirement Income Security Act (ERISA). The PBGC was created "to protect the pensions of American workers and retirees participating in private-sector defined benefit plans" (PBGC, 2010, p. 2). Today, the PBGB protects approximately 44 million workers and retirees by guaranteeing over 29,000 pension plans.

The PBGC, similar to the DSCA, receives no federal funding from tax revenues. All PBGC operations are funded by insurance premiums set by Congress and collected from companies, investment income, assets from pension plans trusteed by PBGC, and investments taken over by PBGC from pension funds of failed companies. Variable insurance rates are dictated by the Pension Protection Act of 2006 and are subject to review by Congress (Inklebarger, 2011). The past five years has seen rates vary from 4.80% to 6.32%, depending on the type of insurance and plan (Pension Benefit Guaranty Corporation [PBGC], 2011).

Currently, the PBGC is in financial trouble. It owes $11 billion more over the next 10 years than it has in assets, and the Brookings Institute, a Washington D.C. think tank, estimates the deficit could balloon to over $100 billion in a worst-case scenario (Elliott, 2009). This deficit was created by underfunded pension plans resulting from the bursting of the dot-com bubble, which decreased investments in equity securities in pension funds. The recent recession has also severely impacted investment accounts through lower equity values and reduced investment income from interest and dividends. Demonstrating this, if General Motors and Chrysler had not been rescued from bankruptcy, the PBGC would have been required to assume the enormous pension liabilities of these companies ("Is the PBGC Next," 2008).

The PBGC mimics the DSCA because it was designed by Congress to operate as a break-even organization that receives zero tax revenues. Unlike the DSCA, the PBGC receives its operating income from a variety of sources, and not just one administrative surcharge. In addition, PBGC's income is not differentiated between administrative and future funds to be paid out, unlike the DSCA, which separates case-management income from administrative income. Because the PBGC has a continuous stream of income from insurance premiums, there is no issue in paying administrative costs along with paying out pensions, at least for the short-term.

The one advantage PBGC has over the DSCA is that it has a very clear picture of their cost drivers and future expenses. PBGC is able to forecast fairly accurately what benefits are to be paid out and what future expenses will be, unlike the DSCA. PBGC also has the luxury of setting a variable premium, while the DSCA is required to use a fixed surcharge rate. However, Congress sets maximum caps on what PBGC can charge for premiums, which is one cause of their long-term shortfall. While similar in nature, no unique aspects of PBGC's business operations can be used by the DSCA to manage their trust fund account.

III. METHODOLOGY

A. GENERAL APPROACH

A primary concern for the DSCA DBO is to ensure the health of FMS business operations. The DSCA's financial solvency is attained by managing the levels in the administrative trust fund. Two basic factors that influence the ebb and flow of the trust fund are revenues and expenses. FPIO manages revenues using two levers; the administrative surcharge rate and the collections schedule. Annual revenue is approximated by applying the surcharge rate and historical collection experience to account for both new FMS and revenue streams from prior-year FMS. The comptroller controls expenses by allocating budget levels annually to the implementing agencies that execute the FMS programs. However, the comptroller accomplishes this task without the benefit of actual cost data.

Our study conducts a financial analysis of the DSCA by addressing the following research questions:

(1) Cost Structure: What is the general cost structure of the DSCA?
(2) Cost Drivers: What are the relevant cost drivers of administering the FMS program?
(3) DSCA Fees Study Group: Was the 2005 internal study that established the 3.8% administrative surcharge rate well-founded?
(4) Administrative Surcharge Rate: What is the optimal administrative surcharge rate to ensure a healthy trust fund balance?

Throughout our analysis, we normalized all dollar values to constant FY2010 dollars. We used the Joint Inflation Calculator (JIC) from the Naval Center for Cost Analysis (NCCA) to adjust for inflation based on the OSD cost element for DoD-wide civilian pay (Naval Center for Cost Analysis [NCAA], 2011).

B. COST STRUCTURE ANALYSIS

Beginning in 2005, the DSCA began implementing an online database to synchronize budget data across IAs known as the Enterprise Planner database. Enterprise Planner includes budget execution data from 2005 to the current year, and Program Objective Memorandum (POM) figures for out-years. The database organizes budget execution data by object classification and work years. We evaluated the cost structure of the DSCA by identifying trends in object class expenditures from FY2005 to FY2010.

Object classes identify the types of goods or services purchased. OMB Circular A-11, Section 83 defines object classes as "categories in a classification system that presents obligations by the items or services purchased by the Federal Government" (OMB, 2010b). The five major object classes are presented in Table 4.

Table 4. General Object Class Codes
(OMB, 2010b)

Object Class Code	Description
10	Personnel compensation and benefits
20	Contractual services and supplies
30	Acquisition of assets
40	Grants and fixed charges
90	Other

Government organizations record more specific object classes within these five major categories. Table 5 lists the object classes recorded by the DSCA and available through the Enterprise Planner database.

Table 5. DSCA Object Classes
(DSCA, 2010a)

(11.10) Civilian Full-time Permanent	(24.00) Printing and Reproduction
(11.30) Civilian Not Full-time Permanent	(25.10) Other Services Non ADP
(11.50) Other Civilian compensation	(25.20) Training
(11.70) Military personnel	(25.30) Purchases of goods and services from Govt.
(11.90) Total Personnel Compensation	(25.40) Operations & Maintenance of Facilities (No
(12.10) Civilian Personnel Benefits	(25.50) R&D Contracts
(12.20) Military Personnel Benefits	(25.70) Other Services ADP
(12.00) Personnel Benefits (Total)	(25.00) Other contractual services (Total)
(13.00) Benefits for Former Personnel	(26.00) Supplies and Materials
(21.00) Travel and Transportation of Persons	(31.10) Equipment - Non-ADP
(22.00) Transportation of Things	(31.20) Equipment - ADP
(23.20) Rental Payments to Others (Non-Federal)	(31.00) Equipment (Total)
(23.30) Comm, Utilities, and Misc Charges	(99.50) SDR
(23.00) Rent, Communications and Utilities (Total)	Object Class Total

It is important to note that object classes represent "obligations according to their initial purpose" (OMB, 2010b) and may not always reflect what was actually purchased or the services provided. However, since object class data in Enterprise Planner is continuously updated throughout the year of execution as transfers are made between government accounts, we can safely assume that object class data for prior years represents actual expenditures, not just obligations.

C. COST DRIVERS—PARAMETRIC COST-ESTIMATING

Since the mid-1990s, parametric cost-estimating techniques have been used in both government and private industries to "maximize the use of historical data in the estimating process, increase estimate realism, and reduce the costs associated with proposal preparation, evaluation, and negotiation estimate costs" (International Society of Parametric Analysts [ISPA], 2008, p. I–4). Parametric cost-estimating analyzes historical data to develop cost-estimating relationships (CER) that can be used to predict future costs. According to the International Society of Parametric Analysts (ISPA) Parametric Estimating Handbook:

> The basic idea in CER development is to 1) identify one or more parameters of a product or project that best explain its cost, 2) find some

> historical data that are representative of the desired cost, and appropriately normalize it, and finally, 3) identify one or more mathematical functions that "fit" the data and that can be used to estimate future costs based on similar plans about future projects. (ISPA, 2008, p. 1–21)

While parametric cost-estimating is primarily utilized to estimate costs of physical systems, these same techniques can be applied to estimate the DSCA's future budgeting requirements. The advantage of this method is that it is founded on quantifiable data. A primary objective of the DSCA's budget process is to allocate funds efficiently to each implementing agency in order to administer the FMS program. The DSCA's entire annual operating budget is also called the Annual Funding Program (AFP). Each year, the DSCA replicates the governmental Planning, Programming, Budgeting, and Execution (PPBE) process to establish their annual operating budget. This budget is then used to allocate funds to IAs and other sub-organizations through the AFP. Historically, the allocation of funds to each IA has been based on "past administrative budget outlays and perceived needs" (GAO, 1999b, p. 4). However, with the recent boom in FMS as well as increasing costs, allocating funds based on incremental budgeting or perceived needs may no longer be a financially viable method.

While each IA is competing for limited budget resources, the DSCA must maintain the long-term health of its business through the efficient allocation of funds. The task for the DSCA becomes particularly difficult without actual cost data, which, if available, could easily be used to justify appropriate funding levels. Because the health of the administrative trust fund depends on expenses as much as revenues, this part of the research aimed to answer the expense question: What drives costs? Thus, a parametric cost-estimating approach is utilized to identify relevant cost drivers and build CERs that can help predict the future costs and funding levels for implementing the FMS program.

1. Basic Regression Model

Through regression and trend analysis, this research attempts to evaluate the cost structure of administering the FMS program and to identify potential cost drivers to predict work levels and future budget requirements. Developing a CER will be valuable to the DSCA in two primary areas. For the comptroller, it will help make future budget

allocation decisions and verify the budgeting requirements requested by the IAs. For FPIO, it will help forecast future expenses to manage the administrative trust fund and ensure the long-term solvency of the DSCA's business operations. Equation 1 shows the basic linear regression equation, which determines the best fit of a line using the least squares method by minimizing the sum of the squared errors.

$$y_i = \beta_0 + \beta_i x_i + \varepsilon_i \quad i = 1, 2, 3 \ldots n \tag{1}$$

Ideally, the dependent variable, y, would represent actual costs. But in the absence of actual cost data, we estimated actual costs by using actual budget execution data. Thus, the actual budget execution dollars served as the dependent or output variable, y. β_0 is a constant that represents the y-intercept. The independent variables x_i will be the various cost drivers or explanatory variables. The coefficient β_i represents the slope of the line related to the explanatory variable x_i. Multiple explanatory variables will be tested to determine the most statistically significant cost factors that best approximate the budget.

a. Data Collection and Normalization

The DSCA Comptroller and FPIO provided budget execution and cost factor data. The Enterprise Planner database was the source for work year data, while cost factor data was retrieved from the Defense Security Assistance Management System (DSAMS). All dollar values were normalized to constant FY2010 dollars. We used the Joint Inflation Calculator (JIC) from the Naval Center for Cost Analysis (NCCA) to adjust for inflation (NCAA, 2011). Since the DSCA is primarily a service-oriented business, with over 70% of their costs associated with civilian personnel and compensation, it is appropriate to use the OSD cost element for DoD-wide civilian pay as the basis for inflation adjustment.

b. Model Acceptance Criteria

The standards to determine an acceptable model were based on the following statistical factors: F-significance; p-values of the explanatory variables; and R squared, followed by testing for multi-collinearity, forecast error analysis, and a

common-sense review. More specifically, the acceptance criteria for a model are as follows:

1. Model F-significance < 0.05,
2. P-values of explanatory variables < 0.05,
3. R squared > 0.80,
4. Correlation between explanatory variables < 0.70, and
5. Mean Absolute Percentage Error (MAPE) < 5%.

F-significance tests the significance of the regression model as a whole. An F-significance less than 0.05 states that there is less than a 5% probability that the results are by chance—or in other words, a 95% confidence level. Evaluating the p-values of explanatory variables applies the same 95% confidence level for each variable. When using multiple variables in a regression model, it is possible for individual variables within a model to be statistically insignificant (p-values > 0.05) while the model as a whole remains significant (F-significance < 0.05). Testing the p-values of individual variables, also called the t-test, will refine our model by only including those variables that are statistically significant. The R-square value, also called the coefficient of determination, is a measure of the "goodness of fit" of the model. R-square values can range from 0 to 1.0. An R-square of 1.0 represents a perfect model that explains 100% of the variation. Our R-square threshold of 0.80 represents a model that explains at least 80% of the variability. Correlation between two variables is called multi-collinearity. High correlation between variables (correlation coefficient, r > 0.70) is undesirable, because we prefer independent variables that are not distorted by changes in other variables. MAPE is a commonly used metric to test forecast accuracy of a model based on percentage error compared to actual data.

c. Budget Estimating Relationship (BER)

Because our models use budget execution data rather than actual cost data, it is more appropriate to identify the CER in terms of budgets rather than costs. Thus we will refer to our CER as a Budget Estimating Relationship (BER). We developed three

BER models to estimate budgets for the DSCA; two models estimate workload and budget requirements for the DSCA as a whole, and one model estimates budgets at the aggregated MILDEP-level. First, a DSCA Work Years model estimates the DSCA's total operating budget using work years as the primary cost driver. Our second DSCA Cost Factor model evaluates six cost factors as explanatory variables that drive work years for the DSCA. The last MILDEP Cost Factor model evaluates six cost factors to estimate total budget requirements for the primary IAs—the Army, the Navy, and the Air Force.

2. Work Years Model

Our DSCA Work Years model validates work years as a measure of workload that drives the DSCA's overall operating budget. A work year (W/Y) describes the amount of work for one worker for one year of output. According to the DSCA, a work year expresses the full-time equivalent (FTE) definition for employment. Civilian full-time employment is generally equal to 40 hours per week each year, or 2,080 non-overtime hours annually (Office of Personnel Management [OPM], 2008). Therefore, an FTE of 1.0 equals one full-time worker or one work year.

Because much of the DSCA's FMS business is service-related, we hypothesized that work years should serve as a reliable predictor for costs. Understanding the impact of work years on fluctuations in FMS will provide insights into the elasticity of the business. Both trend analysis and regression will be utilized to evaluate W/Y changes with the growth in FMS. The following work year categories tracked by the DSCA are outlined to include average work year cost.

- Total Work Years
  - Military Total
    - Active Enlisted W/Y
    - Active Enlisted Part-Time W/Y
    - Active Officer W/Y
    - Active Officer Part-Time W/Y
    - Reserve Officer W/Y
    - Reserve Enlisted W/Y
  - Civilian Total
    - Active Civilian W/Y

        - Active Civilian Part-Time W/Y
    - Contractor W/Y
- Average W/Y Cost

The hypothesized BER for the DSCA Work Years model is shown in Equation 2:

$$Budget\ (FY10\$) = \beta_0 + \beta_1\ Work\ Years \tag{2}$$

This approach evaluates work years as the primary input variable that drives the DSCA's total expenses. Both single- and multiple-variable regressions were utilized to develop a BER based on previously stated model acceptance criteria. A work year category will be added to the model that maintains the statistical significance of the explanatory variable and the overall model.

3. Cost Factor Models

The DSCA identified six cost factors that could potentially drive costs. We evaluated these factors as explanatory variables. The cost factors include the following:

1. Number of LORs received during FY (#LOR),
2. Number of LOAs implemented during FY (#LOA),
3. Number of total open cases (#TOC),
4. Dollar-value of admin surcharge collected during FY ($Admin),
5. Dollar-value of end-of-FY sales ($Sales), and
6. Dollar-value of total open cases ($TOC).

Given the budget execution data and these cost factors, regression analysis was conducted to determine statistical significance of these variables as cost drivers. The six cost factors were split into two main categories: quantity variables and dollar-value variables.

a. Quantity Variables (#LOR, #LOA, #TOC)

The quantity variables attempt to capture any relationship between increased quantities of LORs, LOAs, and/or total open cases. The IAs, primarily the

MILDEPs, receive and process LORs. For each LOR received, there is work associated with generating a response in the form of a P&A report or an LOA. Generally, the IA should respond with a P&A within 45 days or an LOA within 120 days for 80% of all LORs. #LOR captures the changes in costs associated with changes in the number of LORs received during a given year.

#LOA captures the costs associated with changes in the number of LOAs implemented. Although the number of LOAs implemented each year is lower than the number of LORs received, there are additional cost considerations for LOAs. In contrast, LORs have relatively fixed response times, whereas LOA implementation leads to case execution, which is the longest part of the FMS life cycle, lasting several years.

#TOC captures the costs associated with managing all of the cases each year. The cumulative effect of additional open cases may systematically increase the costs associated with managing and administering the FMS program each year. The costs associated with open cases are even less clear, because open cases may remain idle for several years with very little workload. DISAM reports have recognized that reconciliation and case closure is often a slow process and may last several years.

b. Dollar-Value Variables ($Admin, $Sales, $TOC)

The dollar-value variables attempt to capture relationships between the dollar values and workload or budget requirements. $Admin captures the contribution of administrative funds that each MILDEP contributes to the trust fund each year. Because $Admin is largely a function of the administrative surcharge rate applied to annual FY sales, there is likely a correlation between $Admin and $Sales. However, $Admin will vary as a proportion of $Sales due to the number of small case management lines (SCMLs). Small cases with low values incur a minimum charge of $15,000 per case to cover administrative costs. $Sales captures the total value of FMS contracts accepted each year, and $TOC accounts for the total value of all open cases. The dollar-value variables test the notion that higher dollar case values require higher workloads and costs.

The hypothesized BER for our Cost Factor models is shown in Equation 3:

$$Budget\ (FY10\$) =$$

$$\beta_0 + \beta_1 \#LOR + \beta_2 \#LOA + \beta_3 \#TOC + \beta_4 \$Admin + \beta_5 \$Sales + \beta_6 \$TOC \quad (3)$$

We used stepwise backward regression to optimize the model for statistical significance. We omitted explanatory variables with the highest p-values first. Regression iterations continued until we arrived at a model that met all of our acceptance criteria. Note that this model is likely more relevant for estimating budget requirements for the MILDEPs rather than the DSCA as a whole. Because IAs execute FMS cases, these cost factors apply primarily to the three military Services—the Army, the Navy, and the Air Force. However, we did evaluate these cost factors for significance in our DSCA Cost Factor model for estimating work year requirements.

D. 2005 FEES STUDY GROUP ANALYSIS

In 2006, DSCA increased their administrative surcharge rate from 2.5% to 3.8% based on an internal study called the Fees Study Group. The internal study headed by FPIO concluded that the trust fund balance would become insolvent by 2009. In actuality, the trust fund balance has reached record levels exceeding 2 billion dollars. DSCA requested that we evaluate their 2005 internal study to determine if their analysis was well-founded. We evaluated their analysis by replicating the conditions of the study using historical data and power point briefings used by FPIO to justify the rate increase.

E. ADMINISTRATIVE SURCHARGE RATE

One of the primary goals of this thesis is to recommend an administrative surcharge rate to the DSCA that will promote the following characteristics:

1) Stability in the FMS-A. The DSCA is required by law to operate as a break-even entity. This is a balancing act for the DSCA because they need enough money in the FMS–AA to cover operating expenses as well as manage internal projects (such as upgrading their IT systems), yet they don't want too much money in the FMS–AA because it attracts unwanted attention. At the same time, the DSCA is required to maintain minimum funding levels in the FMS–AA for safety reasons.

2) Stability in the administrative surcharge rate. The DSCA desires an administrative surcharge rate that does not change in order to enhance customer satisfaction and simplify internal accounting.

The current rate of 3.8% is not working ideally because the recent growth in FMS from 2006–2010 has increased the FMA–AA to just over $2 billion—a level that is 172% higher than the DSCA's safety level of $734 million. In order to assess an optimal solution for the DSCA's administrative surcharge, we employed a three-step methodology:

1) Preliminary Analysis,

2) Historical Modeling of the FMS–AA, and

3) Simulating the FMS–AA from 2011 to 2015.

Each of these steps will be described in detail below.

1. Preliminary Analysis

Four main data categories were used in evaluating the surcharge rate, with all dollar amounts represented by fiscal year (FY).

- FMS: Total FMS recorded by the DSCA, including FMS and non-FMS programs. FMS data used from 1977 to 2010.
- Revenues: Total amount of money actually collected by the DSCA. Revenues data used from 1984 to 2010.
- Expenses: Total amount of money expended by the DSCA. Expense data used from 1984 to 2010.
- FMS–AA level: Value of the FMS–AA at the end of the fiscal year. FMS–AA data used from 1984 to 2010.

Data was gathered from two different sources. For years prior to 2005, all four categories of data were collected from the DSCA's 2005 internal analysis final report. Data from 2006 to 2010 was provided by the DSCA-FPIO. All data was normalized to FY2010 dollars using the joint inflation calculator (January 2010 version), using the civilian payroll for all services (OSD cost element).

Preliminary analysis included reviewing ratios of FMS compared to expenses in order to identify some basic cost relationships in the FMS–AA. While useful, these ratios have inaccuracies in them because years in which expenses for a case occur do not necessarily match when the FMS for that same case happened. However, initial ballpark surcharge rates could be determined by examining these basic relationships.

Next, the relationship of administrative surcharge rates affecting FMS–AA volatility was examined by reviewing the changes in the year-end balance of the FMS–AA. This relationship gave an indication of how past administrative surcharge rates affected the FMS–AA. This analysis is also not exact because the only changing variable in this analysis is the administrative surcharge rate. These numbers do not take into account changes in the business structure of the DSCA or the changing role of FMS in the world during the years analyzed. It does, however, give another ballpark indication of the success of past rates.

2. Building the Anticipated Earnings Model

For this thesis, we developed the *anticipated earnings model* in order to accurately assess how various surcharge rates affect the FMS–AA. For historical analysis, this model is able to determine the status of the FMS–AA in year *y* by applying a hypothetical administrative surcharge rate in year *x*. This model can also forecast the status of the FMS–AA through 2015 using different FMS and expense models that are described in Section 4.

a. Defining the Anticipated Earnings Model

A sample of the anticipated earnings model from the years 1999 to 2010 is presented in Table 6.

Table 6. Sample From the Anticipated Earnings Model From 1999 to 2010 (DSCA, 2011)

Anticipated Earning Model															
New Admin Surcharge Rate	3.80%														
Discount Factor	85.60%														
$ MILLIONS NORMALIZED (FY10)	1999 FY99	2000 FY00	2001 FY01	2002 FY02	2003 FY03	2004 F04	2005 FY05	2006 FY06	2007 FY07	2008 FY08	2009 FY09	2010 FY10			
FMS	$18,047	$17,127	$18,107	$16,304	$16,269	$16,229	$12,283	$23,577	$25,561	$38,714	$39,031	$31,602			
TOTAL ADMIN COLLECTED	$386	$367	$387	$349	$348	$347	$263	$767	$831	$1,259	$1,270	$1,028			
Net Earnings	$442	$412	$404	$382	$370	$368	$312	$584	$660	$908	$1,019	$928			
Net Expenses	$481	$544	$468	$453	$436	$416	$426	$412	$409	$463	$527	$618			
Net Income (Earning-Expense)	-$39	-$131	-$64	-$71	-$65	-$48	-$114	$172	$250	$445	$493	$310			
New Calculated TF Balance	$799	$668	$604	$533	$468	$419	$306	$478	$728	$1,173	$1,666	$1,979			
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	SUM
Collections Curve	56.30%	9.40%	2.80%	13.63%	5.18%	3.34%	2.80%	2.10%	1.20%	0.95%	0.58%	0.54%	0.51%	0.44%	99.77%

Definitions of the major terms from this model are as follows:

New Admin Surcharge Rate: In the anticipated earnings model, this is where variable administrative rates can be entered to change model conditions.

Discount Factor: An 85.60% discount factor was applied to this model on all sales. Discussion on how this number was derived will be presented later in this section.

FMS: All FMS data used was historical data.

Total Admin Collected: Defined by Equation 4.

Total Admin Collected =

$$FMS * New\ Admin\ Surcharge\ Rate * Discount\ Factor \quad (4)$$

Net Earnings: Equation 5 uses a collections curve (as shown in Table 7) in order to project how much money the DSCA is able to collect in a given year. Equation 5 assumes one is computing the net earnings for FY2010.

$$Net\ Earnings = 2010\ Total\ Admin\ Collected * 56.30\% + 2009\ Total\ Admin\ Collected * 9.40\% + 2008\ Total\ Admin\ Collected * 2.8\% + \ldots + 1998\ Total\ Admin\ Collected * 0.51\% + 1997\ Total\ Admin\ Collected * 0.44\% \quad (5)$$

Net Expenses: All net expense data used was historical data.

Net Income: Defined by Equation 6.

$$Net\ Income = Net\ Earnings - Net\ Expenses \quad (6)$$

New Calculated TF Balance: Defined by Equation 7.

New Calculated TF Balance =

Previous Year TF Balance + Current Year Net Income (7)

b. Generating an Accurate Collections Curve

Currently, the DSCA-FPIO uses a 14-year collections curve that was developed during DSCA's 2005 internal study (see Table 7).

Table 7. 14-Year Collections Curve Model
(DSCA, 2011)

Year	1	2	3	4	5	6	7	
Percentage	56.30%	9.40%	2.80%	13.63%	5.18%	3.34%	2.80%	
Year	8	9	10	11	12	13	14	SUM
Percentage	2.10%	1.20%	0.95%	0.58%	0.54%	0.51%	0.44%	99.77%

In 2010, the DSCA-STR developed a different collections curve model that spans eight years and was derived using 2009 DFAS data (see Table 8).

Table 8. 8-Year Collections Curve Model
(DSCA, 2011)

Year	1	2	3	4	5	6	7	8	SUM
Percentage	57.93%	18.58%	13.13%	6.91%	2.35%	0.80%	0.27%	0.02%	**100.00%**

Since the anticipated earnings can only use one collections curve, we used the Mean Absolute Deviation (MAD) statistic to determine which collections curve was more accurate. MAD assesses the difference between forecasted and actual values. Each fiscal year was analyzed for differences between actual and forecasted values, and we calculated the final MAD score by averaging each year's score together. The lowest MAD value presents the more accurate model.

Both collections curves were individually used in the anticipated earnings model along with the correct historical administration rates. Since no other variables were changed other than the collections curve, this was a solid technique to assess which model was stronger. Table 9 presents the results of the MAD assessment; because the 14-year collections curve had a lower MAD score than the 8-year collections curve, the 14-year model is more accurate and was thus used in this thesis.

Table 9. Results of MAD Comparison of 8- and 14-Year Collections Models (DSCA, 2011)

Year	Actual Earnings	8YR Forecast	Error	14 Year Forecast	Error
1984	$751	$827	75	$748	3
1985	$621	$748	128	$719	98
1986	$461	$548	88	$546	85
1987	$563	$466	98	$509	54
1988	$561	$576	15	$643	82
1989	$542	$545	4	$571	30
1990	$771	$634	137	$627	144
1991	$882	$886	4	$881	1
1992	$698	$746	48	$689	9
1993	$853	$1,170	317	$1,102	249
1994	$484	$776	292	$722	238
1995	$874	$595	279	$536	338
1996	$580	$523	57	$621	41
1997	$595	$418	176	$494	101
1998	$500	$372	128	$431	69
1999	$541	$381	161	$442	100
2000	$450	$368	82	$412	38
2001	$400	$380	21	$404	4
2002	$408	$361	47	$382	27
2003	$378	$356	22	$370	7
2004	$363	$351	12	$368	5
2005	$363	$300	63	$312	51
2006	$543	$575	32	$584	41
2007	$718	$695	23	$660	58
2008	$1,003	$1,015	12	$908	95
2009	$1,101	$1,142	40	$1,019	82
2010	$922	$1,075	153	$928	6
MAD			93		76

c. Discount Factor

The DSCA's internal models for assessing future collections use a discount factor of 96.6%. This discount factor was created using historical precedence and is the estimated amount of revenue that the DSCA actually expects to collect. Per this model, for each anticipated $1 of revenue, the DSCA will only see $0.97 of that money.

When building the anticipated earnings model, we initially started by using the DSCA's calculated discount factor; however, in testing the model, we realized that outputted model results were not matching expected results, especially when inputting the correct historical administration rates. Through a process of trial and error, we determined that inputting a calibration factor of 85.60% caused the anticipated earnings model to output results that were expected compared to real-world data.

d. Non-FMS Case Consideration

One issue not addressed in the anticipated earnings model is the collections difference between FMS versus non-FMS earnings. The 14-year collections curve used in this thesis assumes approximately 50% collections up front. Because non-FMS cases charge a 100% up front administrative fee, the collections schedule is different. This factor was not accounted for in the anticipated earnings model, because non-FMS cases usually account for less than 20% of total case dollar values. As can be seen in Section e, this did not affect model validity significantly.

e. Model Validity

Because we collected historical data from 1984 to 2010, we initially hoped that the anticipated earnings model would provide accurate results from 1984 to the present day. Preliminary testing, however, found inaccurate results in the years from 1984 to 1999. Figure 14 demonstrates the output of the model from 1984 to 2010 using correct historical administrative rates, compared to the actual ending balances of the FMS–AA.

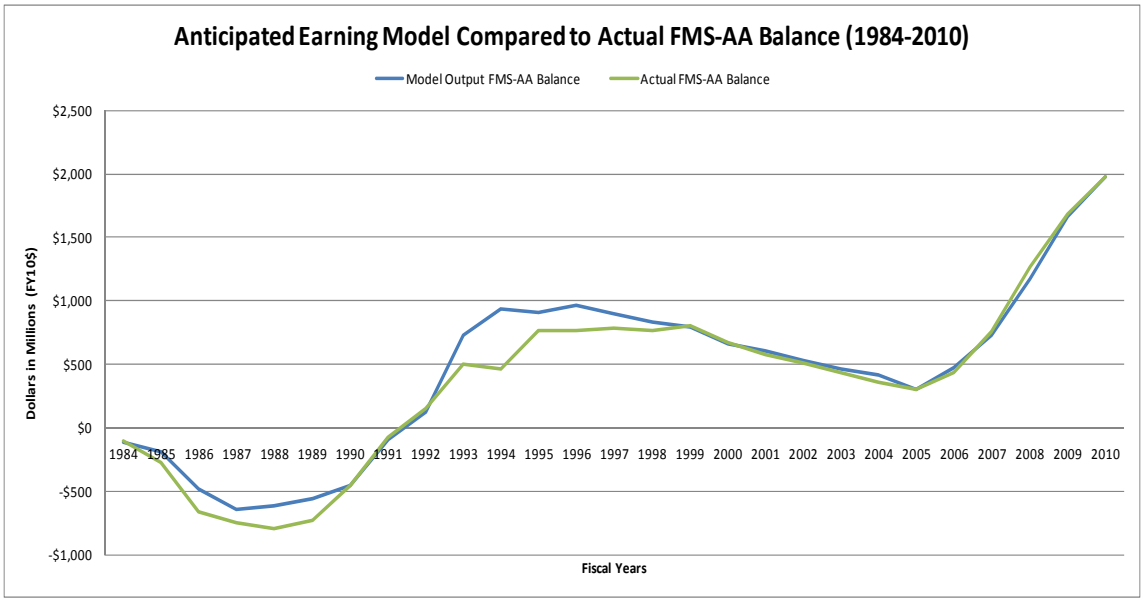


Figure 14. Anticipated Earnings Model Compared to Actual FMS–AA Balance (1984–2010)

As can be seen in Figure 14, from 1984 to 1999, real-world FMS–AA balances were 22.7% different than calculated FMS–AA balances using the anticipated earnings model. Based on this result, we elected to use data output from only 1999 onwards for this model. From 1999 to 2010, the difference between the anticipated earnings model using correct historical administrative rates and actual FMS–AA balances was 4.4% per year, which is within an acceptable error threshold.

Figure 15 presents the validity of the anticipated earnings model from 1999 to 2010. The final version of the model used in this thesis begins in 1999, uses an 85.6% discount factor, and uses the 14-year collections curve.

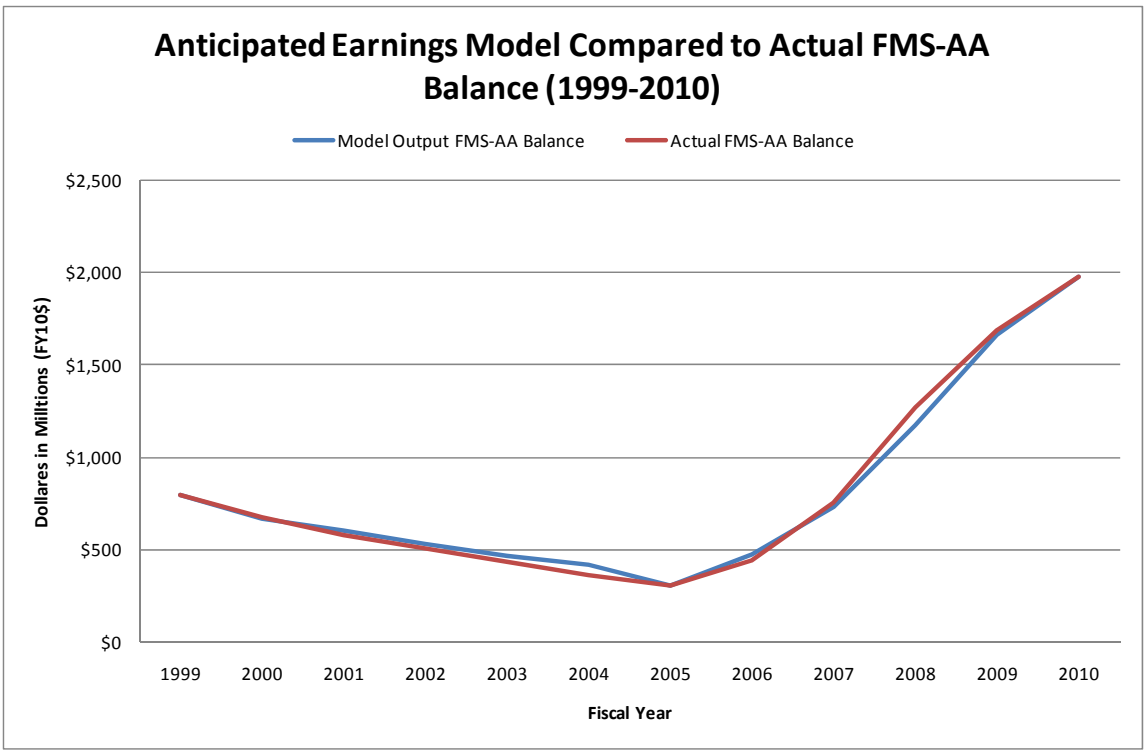


Figure 15. Anticipated Earnings Model Compared to Actual FMS–AA Balance (1999–2010)

3. Historical Modeling of the FMS–AA

Once we built the anticipated earnings model, it was possible to create a historical model of the FMS–AA that answers the question, If *x* administrative surcharge rate was applied in 1999, the ending balance of the FMS–AA in 2010 was *y*. All surcharge rates between 2.0 and 4.0% were tested (using a difference of 0.1%). Our final results in Chapter IV present the most significant findings.

4. Simulating the FMS–AA From 2011 to 2015

The FMS–AA was forecasted from 2011 to 2015 using five FMS and two expense models. In order to successfully accomplish this task, we set up the anticipated earnings model from 1999–2010 by mimicking accurate historical administrative surcharge rates and then hardcoded the 2010 ending FMS–AA balance to the correct 2010 historical FMS–AA balance. Correct setup of the model was imperative to ensure

accurate simulated earnings and ending FMS–AA balances in 2011 to 2015. Finally, 2011 to 2015 FMS and expenses were manually inputted using the following models.

- Sales Model 1: Aggressive FMS growth
- Sales Model 2: Reduced FMS
- Sales Model 3: 2010 FMS levels
- Sales Model 4: Monte Carlo simulations
- Expense Model 1: Cost driver expense model
- Expense Model 2: Flat expense model

a. Aggressive FMS Growth

The aggressive FMS growth model was based on the DSCA's most optimistic FMS forecasts from 2011 to 2015. This model was used to show what could happen if FMS continues to increase at 2005 to 2010 rates and was developed by the DSCA-STR by doing regression analysis on 2005 to 2010 FMS data. The FMS regression equation (Equation 8) is as follows:

$$FMS = -1{,}1955{,}945 + 5{,}968.35 * Year \quad (8)$$

Results of this FMS model are shown in Table 10.

Table 10. Aggressive Sales Growth Model ($Millions)

Model	FY11	FY12	FY13	FY14	FY15
Aggressive FMS Growth	$46,407	$52,375	$58,344	$64,312	$70,280

b. Reduced FMS

The goal of the reduced FMS model (see Table 11) was to show what would happen to the FMS–AA if FMS reduced back to levels seen in the 1990s and early 2000s. To demonstrate this, we focused on the years 1995 to 2005 because those years demonstrated a stable FMS level where FMS each year were within 10% of the preceding or next year. We then averaged the FMS of those years together and applied those FMS rates from 2011 to 2015.

Table 11. Reduced FMS Model ($Millions)

Model	FY11	FY12	FY13	FY14	FY15
Reduced FMS	$15,758	$15,758	$15,758	$15,758	$15,758

c. 2010 FMS Levels

The goal of the 2010 FMS levels model was to see the effect on the FMS–AA if FMS rates stayed at 2010 levels. All data in Table 12 was normalized to FY2010 levels.

Table 12. 2010 FMS Levels Model ($Millions)

Model	FY11	FY12	FY13	FY14	FY15
2010 FMS Level	$31,758	$31,758	$32,305	$33,049	$33,809

d. Monte Carlo FMS Simulations

Predicting future FMS levels tends to be more of an art than a science, so we devised a way to simulate the most likely future FMS. Monte Carlo simulations take probability distributions of input variables and then apply them over *x* amount of trials to determine the full range of possible outcomes and the probabilities associated with these outcomes. For this thesis, we accomplished Monte Carlo simulations using two different probability distributions.

Probability Distribution 1

For the first Monte Carlo model, "buckets" that were $2,500 million large were used to divide up historical end-of-year FMS. For example, all yearly FMS of $10,000–12,500 million would be in one bucket, FMS from $12,501–$15,000 million in the next, and so on. Figure 16 shows the results, with the dollar amount representing the mid-point of each bucket and the number of occurrences representing how many times an end-of-year FMS was in a particular bucket.

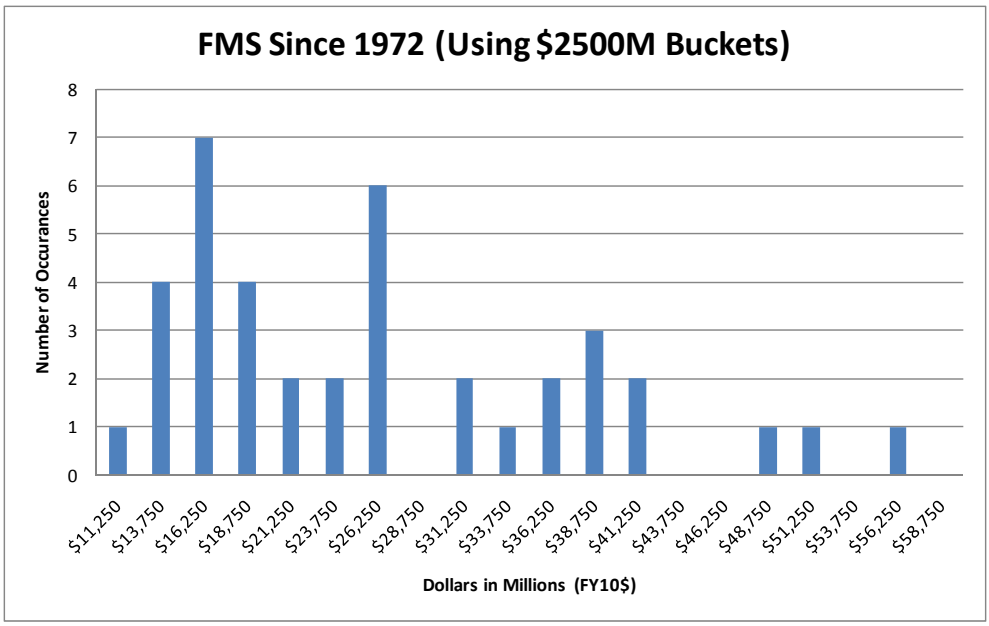


Figure 16. Histogram: FMS Since 1972 (Using $2,500 Million Buckets)

After placing year-end FMS into buckets, probability distributions of forecasted FMS were developed using this data. For example, using Table 13's distribution, we could say that next year, there is a 2.6% chance that FMS will be $11,250 million.

Table 13. Probability Distribution of Year-End FMS Using $2,500 Million Buckets (Values in Millions)

$11,250	$13,750	$16,250	$18,750	$21,250	$23,750	$26,250	$28,750	$31,250	$33,750
2.6%	10.3%	17.9%	10.3%	5.1%	5.1%	15.4%	0.0%	5.1%	2.6%
$36,250	**$38,750**	**$41,250**	**$43,750**	**$46,250**	**$48,750**	**$51,250**	**$53,750**	**$56,250**	**$58,750**
5.1%	7.7%	5.1%	0.0%	0.0%	2.6%	2.6%	0.0%	2.6%	0.0%

Using the probability distributions shown in Table 13, we utilized Microsoft Excel to run 200 trials simulating FMS from 2011 to 2015. Yearly results were then averaged together, resulting in the predicted FMS for 2011 to 2015 presented in Table 14.

Table 14. Monte Carlo Model 1

Model	FY11	FY12	FY13	FY14	FY15
Monte Carlo (Prob Dist 1)	$26,563	$25,600	$27,638	$26,813	$26,725

Probability Distribution 2

For the second probability distribution, we made the assumption that FMS data was normally distributed (similar to a bell curve). Based on this assumption, we were able to run 1,000 trials using a simulation program[1]. Inputs to the program were *FMS Mean* and *FMS Standard Deviation*. We obtained both values using the Descriptive Statistics function in Excel employing FMS since 1972. (See Table 15.)

Table 15. FMS Mean and Standard Deviation

FMS Mean	FMS Std Dev
$26,342	$11,567

The simulation program provided results for average FMS over 1,000 trials for each of the five years simulated. Those results are displayed in Table 16.

Table 16. Monte Carlo Model 2

Model	FY11	FY12	FY13	FY14	FY15
Monte Carlo (Prob Dist 2)	$26,448	$25,870	$25,547	$26,561	$26,339

Final Monte Carlo Results

In Probability Distribution 2, we made an important assumption in saying that yearly FMS was normally distributed. We did this based on the "eyeball" test of the distribution of FMS over the years. Validating this assumption is the fact that Probability Distribution 1 results are only 1.9% different than Probability Distribution 2 results. Because the results were almost exact, Monte Carlo results in Chapter IV are presented as one set of data (we elected to use Probability Distribution 2 data to represent Monte Carlo). Using Probability Distribution 2 results also allowed us to conduct a sensitivity analysis of the data, which is discussed later.

Another important result of the Monte Carlo simulations was discovering the probability of occurrence of other future FMS models. Assuming FMS are normally distributed, we then know that any FMS within one standard deviation of the mean has a 68% chance of occurring, such as the Monte Carlo Model. Because both the Aggressive

[1] The program is called Cost Estimation Monte Carlo Model, version 0.9.2, developed by Arnold Buss, 2010, Naval Postgraduate School.

Sales and Reduced Sales models occur within 1–2 standard deviations from the mean, both models have approximately 15% chance of occurring.

e. Cost Driver Expense Model

For the Cost Driver Expense Model we utilized the DSCA Work Years Model to estimate the DSCA's future budget based on work years. Civilian and contractor work years were forecasted using linear regression. These forecasted work years were then used in the budget estimating relationship to predict expenses for 2011 to 2015. Forecasted expenses are presented in Table 17. The significant takeaway for this model is that expenses increase linearly over a five-year period, independent of FMS levels.

Table 17. Cost Driver Expense Model

Model	FY11	FY12	FY13	FY14	FY15
Cost Driver Expense Model	$681	$754	$826	$899	$972

f. Flat Expense Model

We based the second expense model on projected FY2011 expenses used by the DSCA. Because the DSCA-FPIO typically uses a flat expense model to make FMS–AA projections, we used FY2011 expenses projected over five years. The biggest difference between the flat expense and the cost driver expense models is that costs are $381 million less over a total of five years for flat expenses. (See Table 18.)

Table 18. Flat Expense Model

Model	FY11	FY12	FY13	FY14	FY15
Flat Expense Model	$750	$750	$750	$750	$750

5. Sensitivity Analysis

In the Monte Carlo model, we assumed that all FMS followed a normal distribution. Because of this, we were able to conduct a sensitivity analysis on using different administrative surcharge rates. This sensitivity analysis forecasts the probability that an administrative surcharge rate will either exceed or go below a threshold limit by 2015.

For example, we could take a sample rate, say 2.5%, and then determine the probability that over a five-year period, it would fall below a certain dollar amount (we'll use $1 billion for this example). To accomplish this, using the anticipated earnings model, you can simulate FMS over five years to find out what FMS are required to leave $1 billion as the final balance in the FMS–AA in 2015 (in this case, a total of $93 billion in FMS over five years is needed using Flat Expense projections).

The simulation program used in Probability Distribution 2 gave the *FMS Mean ($130,764 million)* and *FMS Standard Deviation ($26,226 million)* for all five years that the simulations were run. With the knowledge of mean, standard deviation, and required FMS, the NormDist function in Excel returns probability of occurrence. For example, $93,000 million FMS and a 2.5% administration rate returns a probability of 7.5% of occurrence.

For the high threshold sensitivity analysis (the probability of exceeding a threshold by 2015) the same inputs were used, however, in Excel the (1-NormDist) function was used instead of NormDist.

IV. RESULTS

A. COST STRUCTURE

This section of the research provides a financial assessment of the DSCA's general cost structure and budget trends.

1. Trend Analysis

We normalized all FMS and expense values to constant FY2010 dollars and conducted a time-series trend analysis. Figure 17 illustrates the annual FMS and budget for the DSCA from 1977 to 2010.

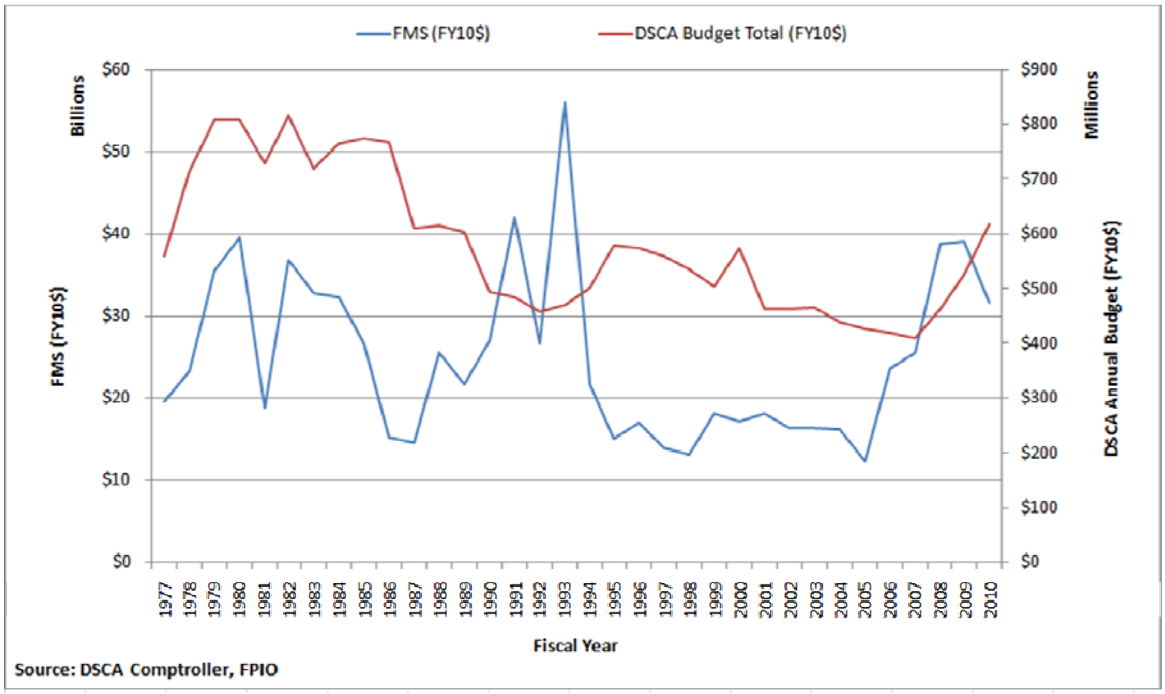


Figure 17. DSCA Foreign Military Sales and Budget (FY1977–2010)
(DSCA, 2011)

a. FMS Trends

From 1995 to 2005, annual FMS remained relatively stable with a mean of $15.8 billion and a standard deviation of $1.9 billion in constant FY2010 dollars. We will refer to this decade of consistent FMS as the "stable years." However, in the last five years, FMS more than doubled—exceeding $39 billion in 2009 and $31.6 billion in

2010. We found that much of the DSCA's prior analysis focused on the years from 1995 to 2010, which only shows half the picture. When we consider a longer time series extending back to 1977, we find that the recent growth in FMS is not unprecedented. In fact, the average FMS from 1977 to 2010 exceeds $26 billion dollars—$10 billion more than the average FMS during the stable years. While FMS from 1995 to 2005 were indeed stable, they also represented a period of historic lows that could better be described as the "lean" years. Observing the long-term history of FMS supports the conjecture that the recent growth in FMS is merely regression to the mean.

b. Budget Trends

During the stable years, budget levels were actually decreasing in constant dollars. Along with the recent FMS growth that commenced in 2006, the DSCA's expenses also increased. Notice that the recent rise in budget levels lagged the FMS boom by approximately two years. In 2006, the DSCA's total budget was $419.2 million compared to $617.9 million in 2010—a 47% increase in four years. The growth in expenses over the last few years has elevated the DSCA's total budget to pre-1990 funding levels. The following cost structure analysis will focus on data from 2005 to 2010 as the "relevant range" to understand the most recent cost growth.

2. Object Class Analysis

The DSCA's total budget is divided into eleven major object class categories. Figure 18 illustrates the DSCA's budget execution by object class from 2005 to 2010. Examining the relative size of each object class paints a clear picture of the DSCA's general cost structure. Notice the large portion of personnel compensation and contractual services compared to the relatively small share of overhead costs such as rent, utilities, and equipment.

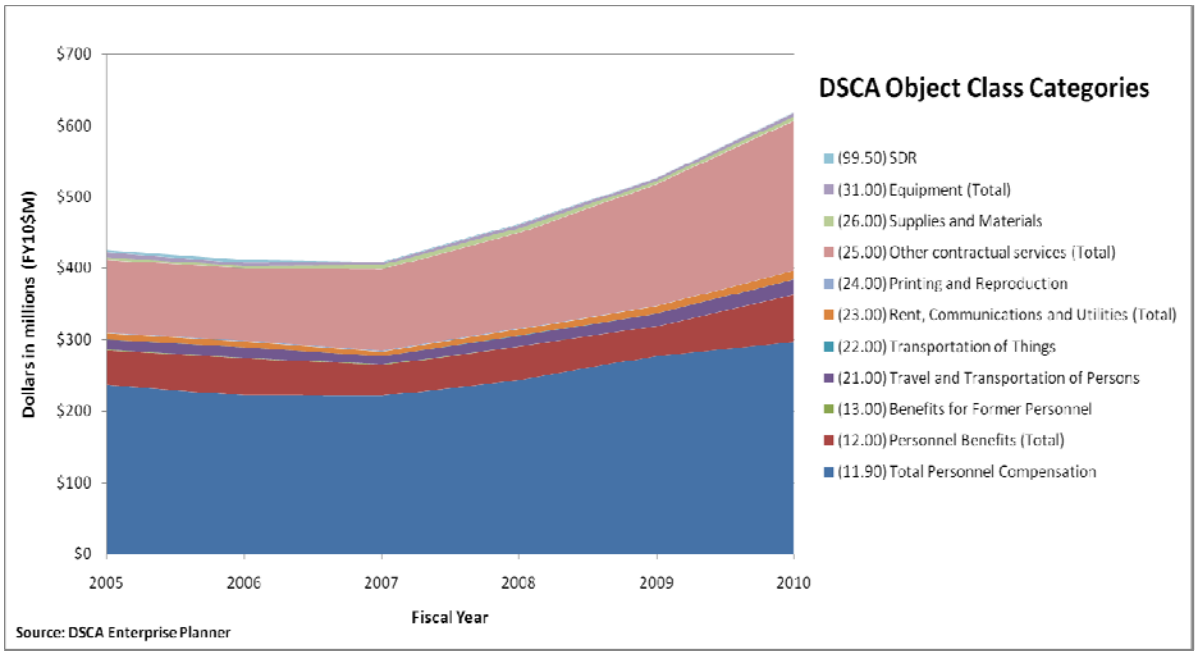


Figure 18. DSCA Budget Execution by Object Class (FY2005–2010)
(DSCA, 2010a)

Figure 19 illustrates the top three object class categories by dollar values, which consist of the following: (11.90) total personnel compensation, (12.00) personnel benefits, and (25.00) other contractual services. From 2005 to 2010, these top three object classes account for over 90% of the DSCA's total budget each year.

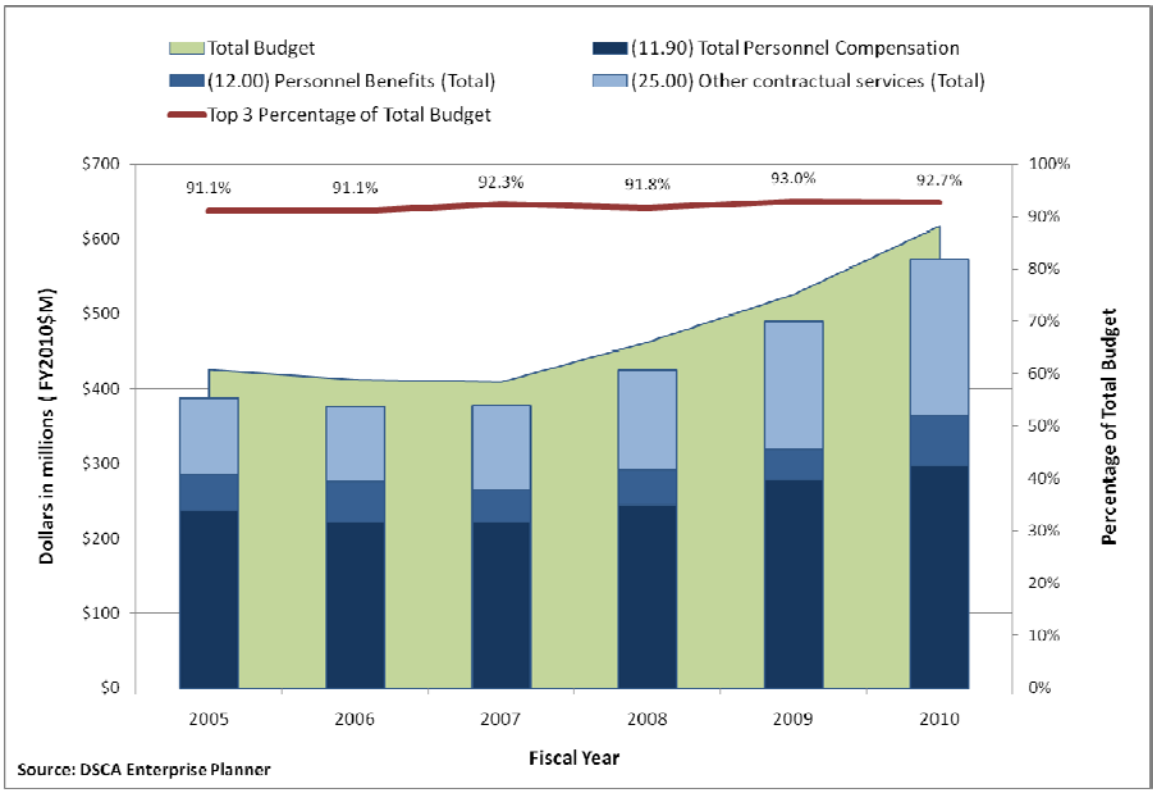


Figure 19. DSCA Top 3 Object Classes (FY2005–2010)
(DSCA, 2010a)

Object classes (11.90) total personnel compensation and (12.00) personnel benefits are both associated with personnel labor costs. In 2005, these two object classes together accounted for 67% of the DSCA's total budget. However, Figure 20 shows that the DSCA's personnel costs as a share of the total budget is on a decreasing trend, accounting for less than 59% of the total budget in 2010. Meanwhile, (25.00) other contractual services have increased as a percentage of the total budget during those same years. From 2005 to 2010, it appears that the decrease in the percentage of the DSCA's personnel costs has been displaced by the 10% increase in other contractual services.

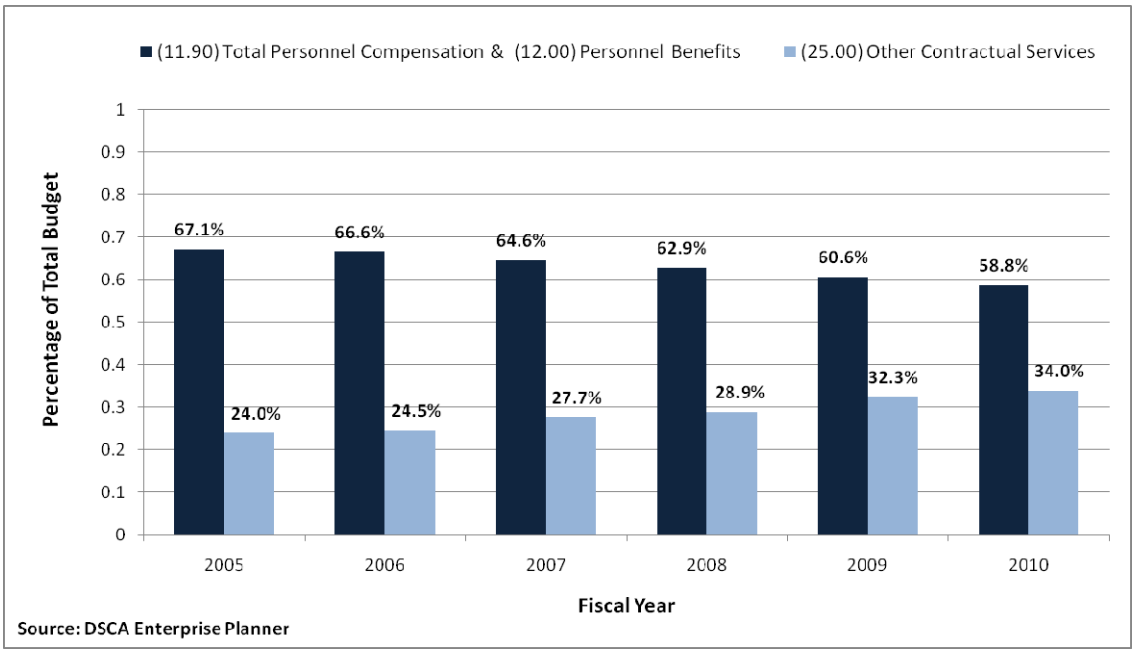


Figure 20. Top 3 Object Classes—Share of Total Budget (FY2005–2010)
(DSCA, 2010a)

Our object class analysis clearly shows that the cost of administering the FMS program is due to personnel related and contractor costs—accounting for over 90% of their operating expenses for each of the last five years. Thus, the DSCA would be characterized as a labor intensive, rather than a capital intensive organization.

B. COST DRIVERS

Using parametric cost-estimating techniques, we modeled DSCA's budget and workload using relevant cost drivers. Our analysis resulted in the following three models:

- **DSCA Work Years Model**: uses work years as a cost driver for the DSCA's total operating budget.
- **DSCA Cost Factors Model**: uses cost factors to predict future work year requirements.
- **MILDEP Cost Factors Model**: uses cost factors to estimate MILDEP funding levels.

Cost factors were accepted as relevant cost drivers if they met our criteria for statistical significance established in Chapter III: Methodology.

1. DSCA Work Years Model

The DSCA Work Years model estimates the DSCA's entire annual operating budget. Since the DSCA's business is primarily service-related, workload in terms of personnel labor is measured by work years. This model tests the notion that work years are a measure of work load, which drives the budget. Total work years include civilian, military, and contractor work years. Figure 21 depicts work years from 2005 to 2010, which demonstrates the predominance of the DSCA's civilian work force. In FY2010, civilians accounted for 74% of total work years, with contractors accounting for 17% and military representing only 9% of total work years. Since 2005, there has been a 125% increase in the share of contractor work years as a percentage of the total. In addition to the growth in contractor support, another trend to note is the rising cost of labor. Even after adjusting for inflation, the average work year cost has increased 12.4% from 2005 to 2010.

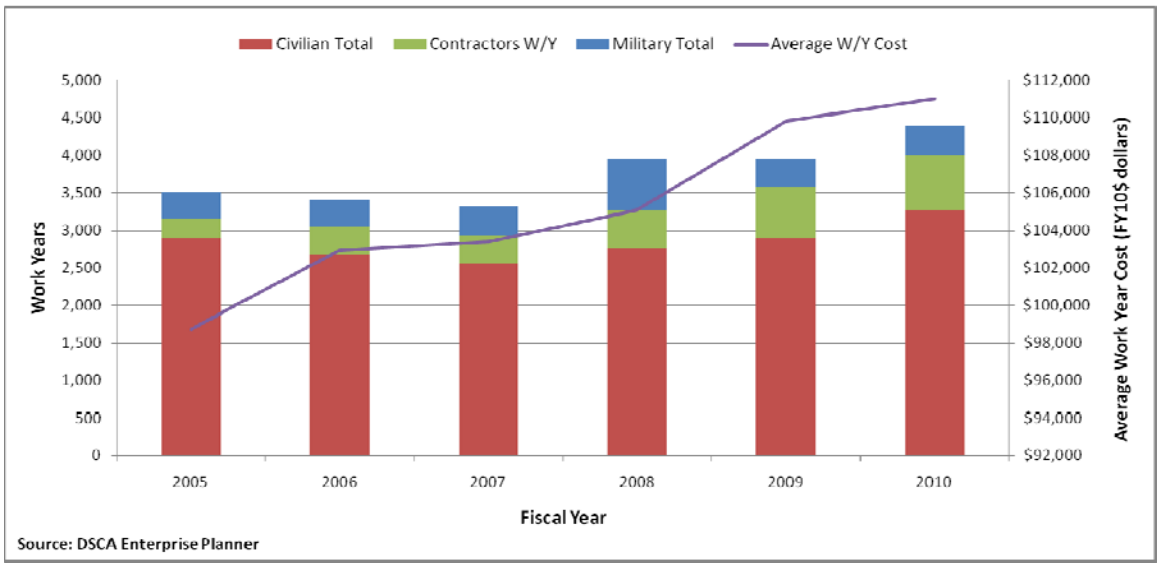


Figure 21. DSCA Total Work Years (FY2005–2010)
(DSCA, 2010a)

Our DSCA Work Year model uses work years as a primary cost driver for the annual budget. Note that this model views work years as an input variable rather than an output or dependent variable. Table 19 outlines the single-variable regression statistics for each work year type to include average work year cost. Military work years proved to be statistically insignificant as an explanatory variable. The single variable that provided

the "best fit" was "work year total," which produced the highest R-square value of 0.90 while meeting all of our acceptance criteria.

Table 19. Single Variable Regression Statistics—DSCA Work Years

DSCA Work Year Model	F	Significance F	R Square
Work Year Total	36.03223896	0.003876173	0.900080532
Civilian Total	18.48060885	0.012656552	0.822068876
Military Total	6.20344E-05	0.994092932	1.55084E-05
Contractors W/Y	23.16415377	0.008567095	0.852747115
Average W/Y Cost	12.75312796	0.023351658	0.761238617

Next, we improved upon the DSCA Work Year model by including more than one explanatory variable. Table 20 provides the regression summary for two model variations. Variation A included all work year components. While the model's overall R-square value increased to 0.99, military work years remained insignificant as an explanatory variable. Omitting military work years in Variation B maintained the R-square value while providing statistically significant p-values for both civilian and contractor work years. Incorporating both civilian and contractor work years in a multi-variable model resulted in a better statistical fit than "total work years" alone, as a single variable.

Table 20. Multi-Variable Model Variations—DSCA Work Years

Model Variation - A	p-values	*F*	*Significance F*	R-square
ALL W/Y Components		79.39260834	0.012464706	0.991672837
Civilian Total	0.030837687			
Contractors W/Y	0.024954573			
Military Total	0.915704631			
Model Variation - B	**p-values**	***F***	***Significance F***	**R-square**
OMIT: Military W/Y		177.3533934	0.000768053	0.991613243
Civilian Total	0.005870475			
Contractors W/Y	0.004406136			

Testing for multi-collinearity presented evidence of moderate to strong correlation between the two explanatory variables. Table 21 presents the correlation matrix between civilian and contractor work years. Although the resulting correlation coefficient of

0.6896 is just below our 0.70 threshold, it is high enough to warrant additional consideration.

Table 21. Correlation Matrix—Civilian and Contractor Work Years

CORRELATION MATRIX	Civilian Total	Contractors W/Y
Civilian Total	1	
Contractors W/Y	**0.689610652**	1

To address the adverse effects of multi-collinearity in our model, we added the civilian and contractor work years together and treated the sum as a single variable. Table 22 presents the regression statistics for our DSCA Work Years model. Although the R-square decreased slightly from 0.9916 to 0.9852 (0.0064 reduction), the F-significance improved and multi-collinearity was effectively negated. We prefer this model because the benefit of eliminating multi-collinearity outweighs the small reduction in the R-square statistic. Thus, our accepted DSCA Work Years model is a single-variable budget estimating relationship that utilizes the sum of civilian and contractor work years as the primary cost driver.

Table 22. Regression Statistics (ANOVA)—DSCA Work Years Model

Regression Statistics					
Multiple R	0.992560575				
R Square	**0.985176495**				
Adjusted R Square	0.981470619				
Standard Error	11.20318701				
Observations	6				
ANOVA					
	df	*SS*	*MS*	***F***	***Significance F***
Regression	1	33366.16611	33366.16611	**265.8417191**	**8.28117E-05**
Residual	4	502.0455965	125.5113991		
Total	5	33868.2117			
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	**-203.637038**	41.91862781	-4.857912787	0.008291799	-320.021807
SUM: Civilian plus Contractor W/Y	**0.204186948**	0.012523232	16.30465329	**8.28117E-05**	0.169416883

Error Analysis

According to this model, the sum of civilian and contractor work years explains 98.5% of the variation in the budget from 2005 to 2010, with a standard error of $11.2

million. Table 23 presents various measures of forecasting errors for the DSCA Work Years model. The standard error of the estimate (SEE) was calculated by dividing the absolute error by the standard error. The SEE ranged from 0.0568 to 1.4111. When compared to actual data, we find the mean absolute error (MAE) to be $6.8 million and the mean absolute percentage error (MAPE) to be only 1.57% from 2005 to 2010. Hence, the DSCA Work Year model provides excellent estimates for the DSCA's annual budget.

Table 23. Forecast Error—DSCA Work Years Model

Fiscal Year	Actual Budget (FY10$M)	Estimated Budget (FY10$M)	Absolute Error	Absolute Percentage Error	Standard Error of Estimate
2005	$425.68	$440.13	14.4523	3.40%	1.2900
2006	$412.49	$417.73	5.2412	1.27%	0.4678
2007	$409.33	$393.52	15.8088	3.86%	1.4111
2008	$462.66	$462.02	0.6361	0.14%	0.0568
2009	$526.45	$527.28	0.8291	0.16%	0.0740
2010	$617.90	$614.07	3.8349	0.62%	0.3423

Budget Estimating Relationship—DSCA Work Year Model

The budget estimating relationship for the DSCA Work Years model can be written as the following:

$$DSCA\ Budget\ (FY10\$M) =$$

$$0.2042\ (Civilian\ Work\ Year + Contractor\ Work\ Years) - 203.64 \quad (9)$$

The use of work years as a predictor for the DSCA's budget is intuitive since the DSCA's business is largely service-oriented and the majority of expenses are personnel costs. It may appear as though using work years as a predictor for the DSCA's budget is self-reinforcing and somewhat trivial. However, the strong relationship between work years and the DSCA's budget highlights the overwhelming influence that personnel costs have in driving the overall budget. For example, the addition of contractor support over the last five years has proven to be a statistically significant cost factor, while changes in military work years are inconsequential.

This model validates civilian and contractor work years as cost drivers for the DSCA's annual budget. The advantages of this model are that it is simple, statistically significant, and easily applied. Applying the budget estimating relationship, DSCA's total budget is predicted to equal $200,000 times the sum of civilian and contractor work years less $200 million. With low demonstrated forecast error, the model can be utilized by DSCA to forecast future budgeting requirements based on work years.

The main limitation of this model is that it applies to the operating environment encountered in 2005 to 2010. If the future operating environment is similar to what DSCA experienced in 2005 to 2010, then this model will maintain its relevance. However, major changes to economic conditions, personnel structure, or even the political environment may distort the estimating relationship. Additionally, using this model to predict future budget requirements is based largely on the ability to accurately forecast civilian and contractor work years. This brings us to the next question: What drives civilian and contractor work years?

2. DSCA Cost Factor Model

Our DSCA Cost Factor model evaluates six cost factors as explanatory variables to explain civilian and contractor work years from 2005 to 2010. Note that we are now treating the sum of civilian and contractor work years as the output, or dependent variable. First, we developed single-variable models by testing each cost factor independently. Table 24 outlines the single-variable regression statistics for the six cost factors. Using a significance level of 0.05, we found that #LOA, $Admin, and $Sales are statistically insignificant. Whereas #TOC and $TOC both have acceptable p-values, their R-squares fall below our 0.80 threshold. #LOR proved to be the only explanatory variable that met all of our model acceptance criteria for statistical significance for a single variable with an R-square value of 0.97.

Table 24. Single Variable Regression Analysis—DSCA Cost Factor Model

DSCA Cost Factor Model	F	F Significance	R Square
# LORs Completed During FY	143.7355645	0.000277424	0.972924597
# LOAs Implemented During FY	1.124179085	0.348797395	0.219387158
Total # Open Cases	7.829526199	0.048904742	0.661863042
$ Admin Collected During FY (FY10$)	2.322030607	0.202228738	0.367291896
$ End of FY Sales (FY10$)	0.866885297	0.404524435	0.178119114
$ Total Case Value of Open Cases (FY10$)	14.33088114	0.019341863	0.781788995

Next, we attempted to improve the model by including more than one variable. After numerous regression iterations, no combination of cost factors produced better statistical significance than our single-variable model using only #LOR. Thus, the best cost driver for civilian and contractor work years is the number of LORs completed during the fiscal year (#LOR). Table 25 presents the regression statistics for our DSCA Cost Factor model.

Table 25. Regression Statistics (ANOVA)—DSCA Cost Factor Model

Regression Statistics					
Multiple R	0.986369402				
R Square	**0.972924597**				
Adjusted R Square	0.966155746				
Standard Error	73.6008192				
Observations	6				
ANOVA					
	df	*SS*	*MS*	***F***	***Significance F***
Regression	1	778627.1359	778627.1359	**143.7355645**	**0.000277424**
Residual	4	21668.32235	5417.080587		
Total	5	800295.4582			
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	**-167.3514093**	293.0321004	-0.571102651	0.598486062	-980.9389501
# LORs Completed During FY	**0.480197447**	0.040053247	11.98897679	**0.000277424**	0.368991806

Error Analysis

According to this model, the number of LORs completed each year explains 97.3% of the variation in civilian and contractor work years from 2005 to 2010, with a standard error of 73.6 work years. Table 26 presents various forecasting errors for the DSCA Cost Factors model. The SEE ranged from 0.0101 to 1.5371. Compared to actual data from 2005 to 2010, our model produced a MAPE of only 1.36%. Thus, this model provides excellent estimates for civilian and contractor work years based on #LOR.

Table 26. Forecast Error—DSCA Cost Factor Model

Fiscal Year	Actual Civilian and Contractor W/Y	Estimated Civilian and Contractor W/Y	Absolute Error	Absolute Percentage Error	Standard Error of Estimate
2005	$3,152.66	$3,068.70	83.9637	2.66%	1.1408
2006	$3,042.97	$3,156.10	113.1301	3.72%	1.5371
2007	$2,924.40	$2,938.09	13.6885	0.47%	0.1860
2008	$3,259.84	$3,219.48	40.3609	1.24%	0.5484
2009	$3,579.41	$3,578.67	0.7448	0.02%	0.0101
2010	$4,004.43	$4,002.68	1.7491	0.04%	0.0238

Work Year Estimating Relationship—DSCA Cost Factor Model

The work year estimating relationship for the DSCA Cost Factor Model can be written as the following:

$$(Civilian\ W/Y + Contractor\ W/Y) = 0.4802\ (\#LOR) - 163.35 \qquad (10)$$

Using the number of LORs as a predictor for work years provides a number of insights into the cost of administering FMS cases. First, #LOR is a quantity variable, which indicates that the number of LORs received matter more than the dollar-values. Secondly, responses to LORs have prescribed time lines specified in the *SAMM*, which bound the time frames required for the workload. P&A responses are provided within 45 days, whereas full LOA responses are normally provided within 120 days for 80% of all LORs (DISAM, 2010, p. 5–6). Additionally, this model relies on DSCA's ability to forecast #LORs to estimate future work year requirements. Figure 22 depicts the #LORs completed by the DSCA each year along with the actual civilian and contractor work years from 2005 to 2010. Figure 22 illustrates the parallel between the sum of civilian and contractor work years and #LOR as the cost factor.

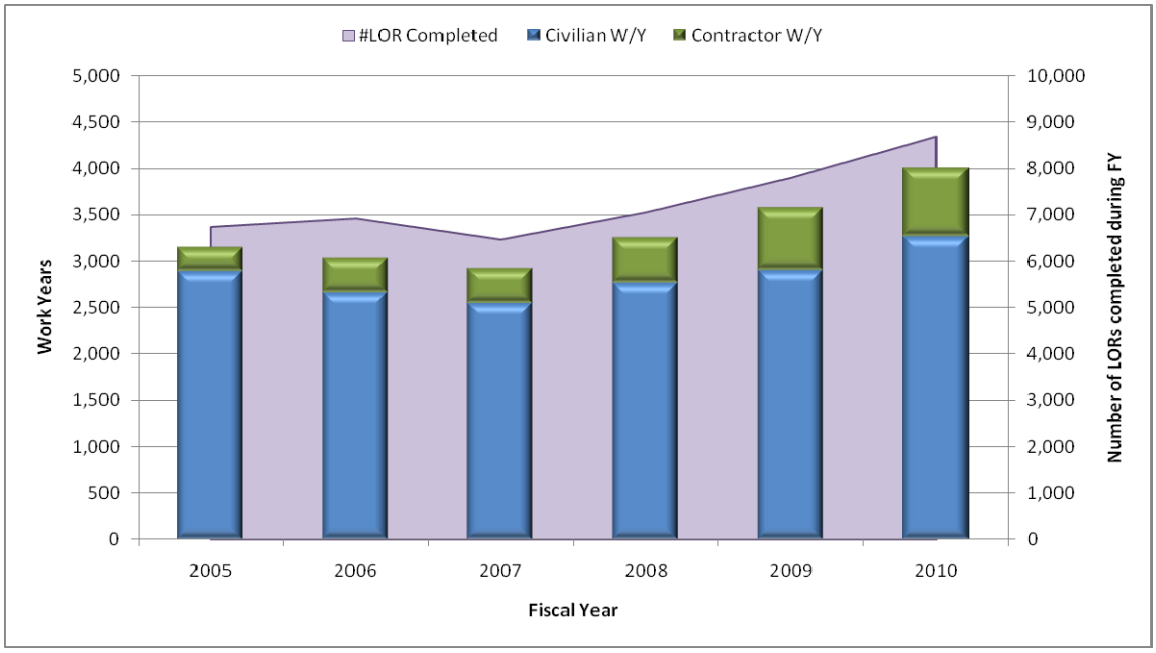


Figure 22. Number of LORs and Work Years (FY2005–2010)
(DSCA, 2010a; DSCA, 2011)

Our DSCA Cost Factor model suggests that the number of LORs completed each year is the best predictor of workload. The DSCA's workload in terms of civilian and contractor work years is estimated by taking 48% of #LOR completed each year minus 163 work years. The advantages of this model are that it is statistically strong with an R-square of 0.97, and as a single-variable model there are no effects of multi-collinearity. DSCA can utilize this model to estimate future civilian and contractor work year levels based solely on the number of LORs completed each year.

Like the DSCA Work Years model, the main limitation of the DSCA Cost Factor model is that it applies to the operating environment experienced in 2005 to 2010. Additionally, it does not consider input from IAs regarding other factors that drive workload and the complexities inherent in implementing each FMS case. To validate this relationship in predicting workload and budgeting requirements, we examined these cost factors at the MILDEP level.

3. MILDEP Cost Factor Model

The DSCA's entire annual operating budget is also called the Annual Funding Program (AFP). Each year, the DSCA replicates the governmental PPBE process to establish their annual operating budget. This budget is then used to allocate funds to IAs and other sub-organizations through the AFP. Figure 23 illustrates the share of funds allocated to each MILDEP annually.

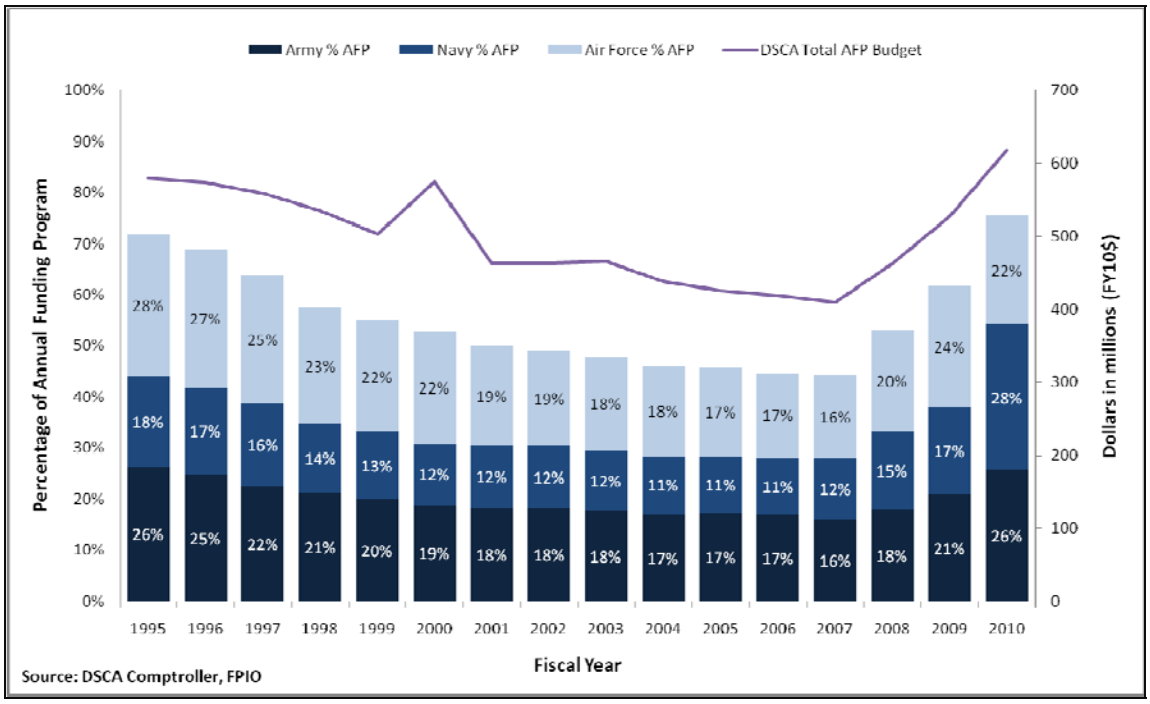


Figure 23. DSCA Annual Funding Program (FY1995–2010)
(DSCA, 2011)

In developing our MILDEP Cost Factor model, we evaluated six cost factors to explain MILDEP annual funding allocations. The output or dependent variable is the annual budget allocation to MILDEPs normalized to FY2010 dollars. Using Defense Security Assistance Management System (DSAMS) data from 2000 to 2010, we tested the explanatory variables for statistical significance.

Table 27 outlines the single-variable regression statistics for the six cost factors at the MILDEP level. #LOA, #TOC, and $Sales proved to be statistically insignificant. $Admin and $TOC both have acceptable F-significance values, but their R-squares fall below our 0.80 threshold. #LOR once again proved to be the only single explanatory variable that met all of our model acceptance criteria for statistical significance, with an R-square value of 0.91.

Table 27. Single-Variable Regression Analysis—MILDEP Cost Factor Model

Cost Factor	F	F Significance	R Square
# LORs Completed During FY	96.04463144	4.23157E-06	0.914322133
# LOAs Implemented During FY	2.784465167	0.129526014	0.236282693
Total # Open Cases	1.399880515	0.267053871	0.134605442
$ Admin Collected During FY (FY10$)	6.932536524	0.02722571	0.435118194
$ End of FY Sales (FY10$)	3.885841207	0.080180253	0.301558986
$ Total Case Value of Open Cases (FY10$)	23.42003705	0.000921759	0.722393901

Next, we sought to improve upon the MILDEP Cost Factor model by including more than one explanatory variable. Table 28 provides a summary table of the multiple regression statistics when all six cost factors are included. While the model's overall R-square value increased to over 0.98, four of the six cost factors proved to be insignificant as explanatory variables.

Table 28. Multi-Variable Regression Statistics—MILDEP Cost Factor Model

MILDEP Multi-Variate Regression	p-value	F	Significance F	R-square
All Six Cost Factors		35.12958224	0.002029787	0.981376075
# LORs Completed During FY	0.017621976			
# LOAs Implemented During FY	0.809878605			
Total # Open Cases	0.024809886			
$ Admin Collected During FY (FY10$)	0.42182118			
$ End of FY Sales (FY10$)	0.53037958			
$ Total Case Value of Open Cases (FY10$)	0.18736043			

We implemented stepwise backwards regression by omitting the least significant variable. In this case, #LOAs was omitted in the first iteration. We continued stepwise regression until we arrived at a model that met our acceptance criteria for statistical significance. The resulting MILDEP Cost Factor model included #LOR and #TOC as the only two explanatory variables, with an R-square value of 0.96. Table 29 outlines the regression statistics for our MILDEP Cost Factor model. Note that this multi-variable

model produces a slightly better statistical "fit" than our single-variable model—increasing the R-square value to explain 4.5% more variability.

Table 29. Regression Statistics—MILDEP Cost Factor Model

Regression Statistics					
Multiple R	0.979247447				
R Square	**0.958925563**				
Adjusted R Square	0.948656954				
Standard Error	12.20459485				
Observations	11				
ANOVA					
	df	*SS*	*MS*	***F***	***Significance F***
Regression	2	27819.54332	13909.77166	**93.38417078**	**2.84634E-06**
Residual	8	1191.617084	148.9521355		
Total	10	29011.16041			
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	**-219.1330911**	38.34260429	-5.715133209	0.000446527	-307.5512951
# LORs Completed During FY	**0.087673684**	0.006919299	12.67089037	**1.41483E-06**	0.071717751
Total # Open Cases	**-0.006493715**	0.00220318	-2.947428733	**0.018498271**	-0.011574257

Testing for multi-collinearity produced a 0.566 correlation coefficient between our two explanatory variables. Table 30 illustrates the correlation matrix for #LOR and #TOC. Though moderate correlation exists between the two variables, the correlation coefficient is acceptable as it remains well below our 0.70 threshold.

Table 30. Correlation Matrix—#LOR and #TOC

CORRELATION MATRIX	# LORs Completed During FY	Total # Open Cases
# LORs Completed During FY	1	
Total # Open Cases	**0.565805946**	1

Negative Regression Coefficient—Total Number of Open Cases

While the DSCA Cost Factor model meets all of our acceptance criteria for statistical significance, the negative regression coefficient for #TOC presents inconclusive results. A negative coefficient implies that as the total number of open cases increases, budget levels will decrease. This is counterintuitive because logically more cases should require more workload and more funding. We examined this phenomenon further to better understand the effects of increasing total number of open cases.

Figure 24 graphically depicts the #LOR and #TOC from 2000 to 2010 for the three MILDEPs along with the LORs as a percentage of total open cases. During the last decade, the #LOR completed each year remains relatively stable, with a slight increase in recent years. The arithmetic mean of #LOR from the last decade is 6,637 LORs with a standard deviation of 676. Based on historical trends, we could expect that the #LORs will remain somewhere between 6,000 and 8,000 each year.

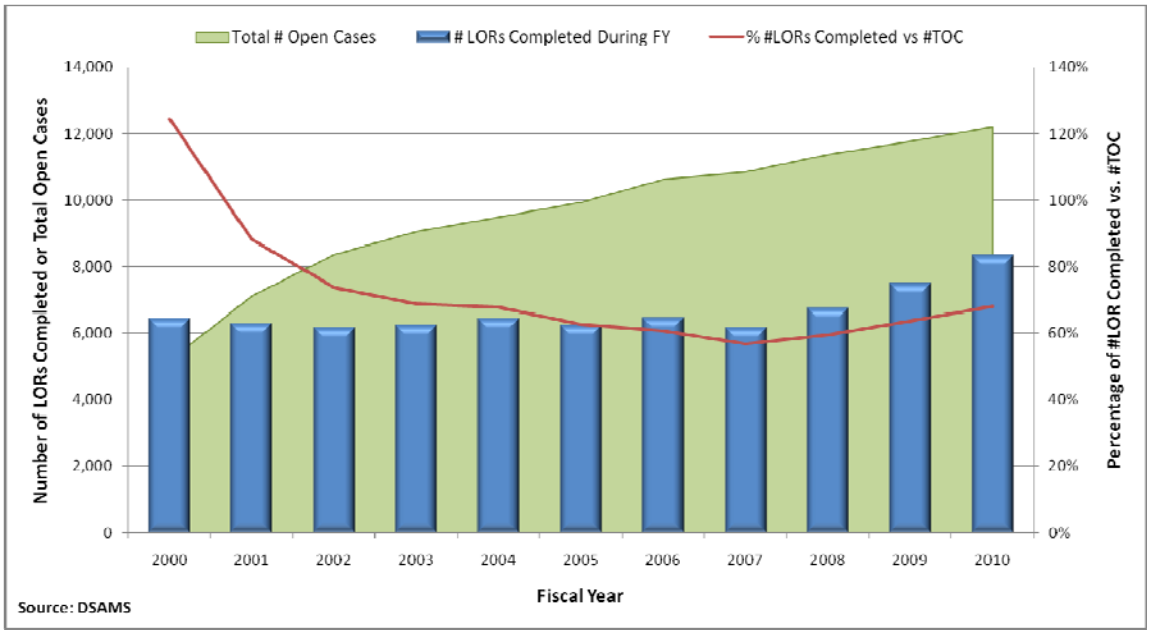


Figure 24. MILDEP LORs and Total Number of Open Cases (FY2000–2010)
(DSCA, 2011)

Notice that in 2001, the total number of open cases exceeds the #LORs for the first time. This is a notable inflection point because the total number of open cases will continue to surpass #LOR each year. Examining the share of #LOR to open cases further demonstrates this transition. In 2000, #LORs represented over 124% of the total number of open cases. Over the last decade, the share of #LORs completed each year as a proportion of open cases has dropped below 70%. The cumulative number of open cases will almost certainly increase over time—widening the gap between #LORs completed in a given year.

When we consider the number of cases actually implemented each year (#LOA), the recent low implementation rates may actually help mitigate the growing number of

open cases. Figure 25 illustrates the MILDEP totals for the number of LORs completed and the number of LOAs implemented from 2000 to 2010. #LOA implemented has remained relatively stable, with a mean of 1,510 LOAs implemented each year and a standard deviation of 162.

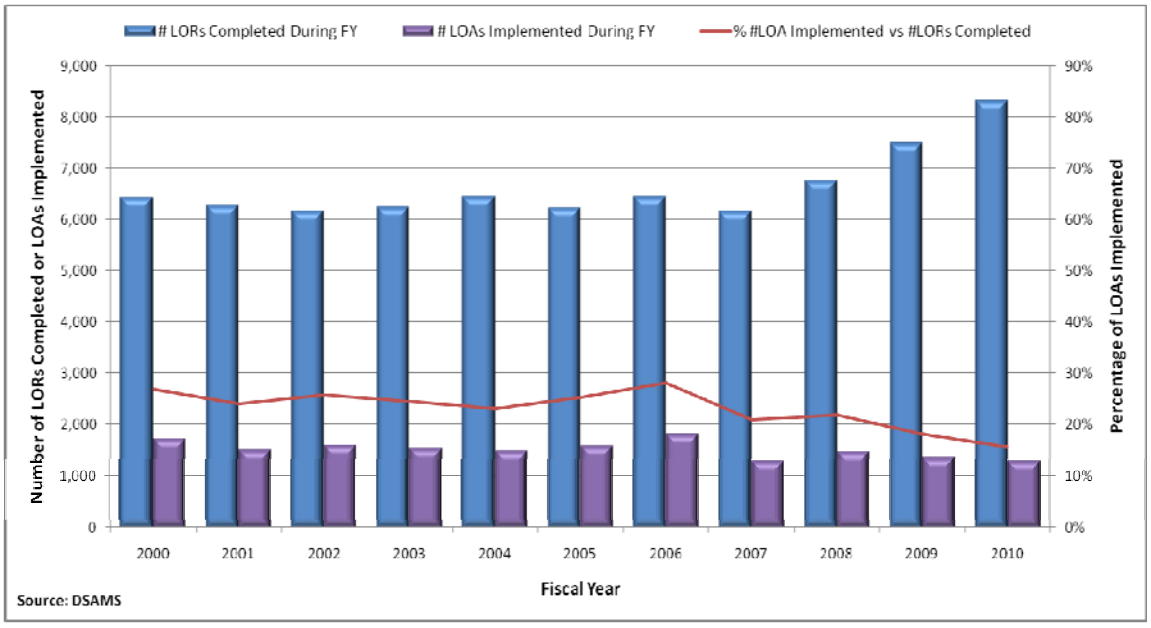


Figure 25. MILDEP LORs Completed and LOAs Implemented (FY2000–2010)
(DSCA, 2011)

Figure 26 shows the trends of LOA implementation. Over the last decade, implementation has been decreasing in both absolute terms and also as a percentage of LORs completed each year. From 2000 to 2008, the MILDEPs implemented between 20–30% of LORs completed each year. However, in the last couple of years, the implementation rate has fallen below 20% to less than 16% in 2010. DSCA should continue to observe the trends in LORs, LOAs, and total open cases to gauge their future case management and workload requirements.

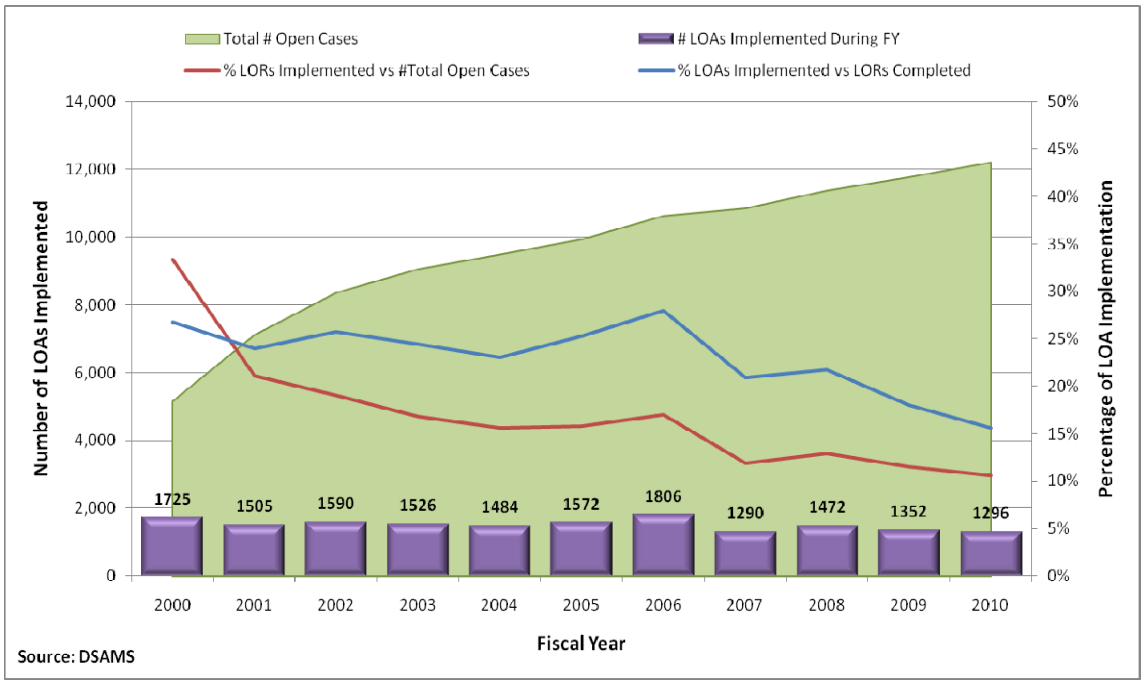


Figure 26. MILDEP LOA Implementation Trends (FY2000–2010)
(DSCA, 2011)

Because the negative coefficient for #TOC is counter-intuitive, we omitted it from our MILDEP Cost Factor model and accept the slight reduction in R-square from 0.96 to 0.91. In the end, our final MILDEP model utilizes the same explanatory variable as the DSCA Cost Factor model—#LOR. Table 31 displays the regression statistics for our accepted MILDEP Cost Factor model.

Table 31. Regression Statistics (ANOVA)—MILDEP Cost Factor Model

Regression Statistics					
Multiple R	0.956201931				
R Square	**0.914322133**				
Adjusted R Square	0.90480237				
Standard Error	16.61864533				
Observations	11				
ANOVA					
	df	*SS*	*MS*	***F***	***Significance F***
Regression	1	26525.54605	26525.54605	**96.04463144**	**4.23157E-06**
Residual	9	2485.614354	276.1793726		
Total	10	29011.16041			
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
Intercept	**-205.1411616**	51.80831879	-3.959618193	0.003306186	-322.3397208
# LORs Completed During FY	**0.076134557**	0.007768645	9.800236295	**4.23157E-06**	0.058560661

Error Analysis

According to this model, the number of LORs completed each year explains 91.4% of the variation in MILDEP funding levels from 2000 to 2010, with a standard error of $16.6 million. Table 32 presents various forecasting errors for the MILDEP Cost Factors model. The SEE ranges from 0.1897 to 1.6387. Compared to actual data from 2000 to 2010, our model produced a MAPE of 4.53%. Thus, this model provides very good estimates for MILDEP budget allocations based on #LOR.

Table 32. Forecast Error—DSCA Cost Factor Model

Fiscal Year	Actual MILDEP Budget (FY10$M)	Estimated MILDEP Budget (FY10$M)	Absolute Error	Percentage Error	Standard Error of Estimate
2000	$305.62	$285.01	20.6111	6.74%	1.2402
2001	$289.35	$273.29	16.0570	5.55%	0.9662
2002	$284.31	$264.84	19.4719	6.85%	1.1717
2003	$276.67	$270.32	6.3520	2.30%	0.3822
2004	$266.36	$285.62	19.2601	7.23%	1.1589
2005	$265.04	$268.95	3.9104	1.48%	0.2353
2006	$258.92	$286.16	27.2336	10.52%	1.6387
2007	$255.97	$264.69	8.7185	3.41%	0.5246
2008	$306.45	$309.60	3.1520	1.03%	0.1897
2009	$356.17	$365.49	9.3168	2.62%	0.5606
2010	$437.47	$428.37	9.0995	2.08%	0.5475

Budget Estimating Relationship—MILDEP Cost Factor Model

The budget estimating relationship for the MILDEP Cost Factor model can be written as follows:

$$MILDEP\ Budget\ (FY10\$M) = 0.07613\ (\#LOR) - 205.14 \quad (11)$$

As seen in the DSCA Cost Factor model, the MILDEP Cost Factor model demonstrates the significance of #LOR in estimating budget requirements. The same advantages and disadvantages apply to the MILDEP model as to the DSCA model. This model is simple and statistically significant but oversimplifies the complex budget allocation process. It is worth noting that the MILDEP Cost Factor model utilizes five additional years of data ranging from 2000 to 2010. The fact that nearly doubling the sample size of the data range resulted in the same significant explanatory variable adds

validity to both models and presents a stronger case for #LOR as a relevant cost driver. This model may be used by the DSCA to validate the funding levels to the MILDEPs based on #LORs. Figure 27 depicts the number of LORs completed and MILDEP funding levels from 2000 to 2010.

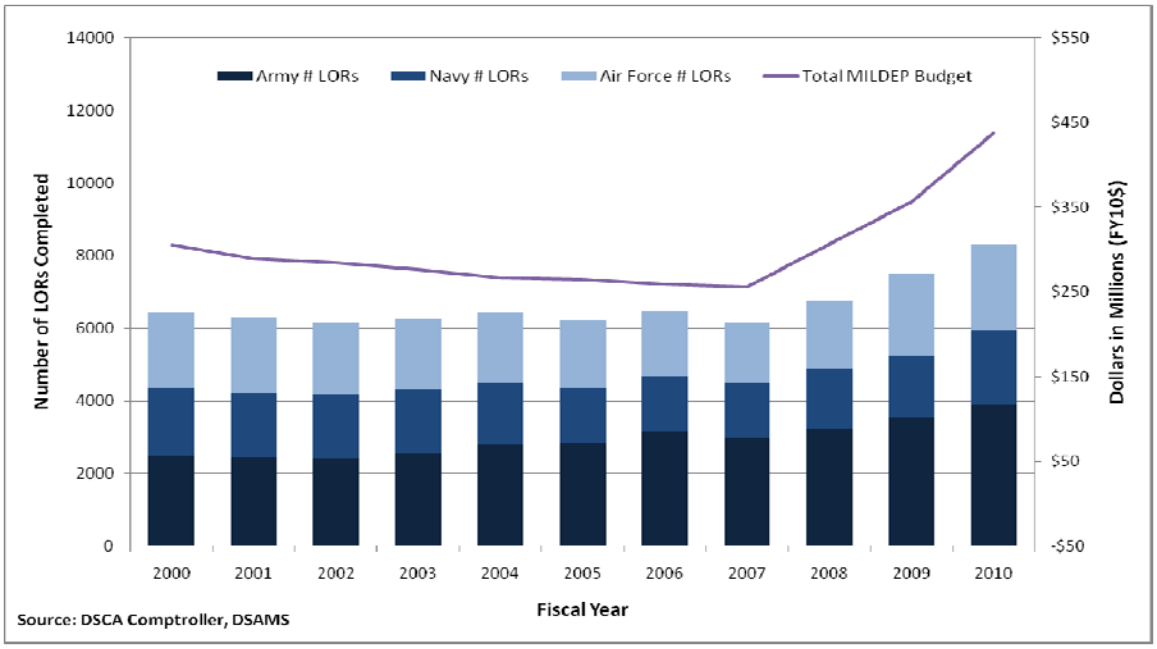


Figure 27. MILDEP #LORs and Total Budget (FY2000–2010)
(DSCA, 2011)

C. THE DSCA'S 2005 INTERNAL STUDY ANALYSIS

The DSCA conducted their 2005 internal study because of a concern that the FMS–AA would become insolvent by 2009 if no actions were taken. The major results of this study were the implementation of the 3.8% administrative surcharge rate, the elimination of the logistics support charge (LSC), the implementation of standard level of service (SLS), and the addition of the small case management line (SCML).

The decision to convene the internal study was valid, as shown by Figure 28. Figure 28 demonstrates the FMS–AA balance using 2010 dollars from 1995 to 1999. The implementation of the 2.5% surcharge rate in 1999 resulted in an average 14.6% decrease in the FMS–AA from 1999 to 2005, supporting the case that the FMS–AA would become insolvent by 2009.

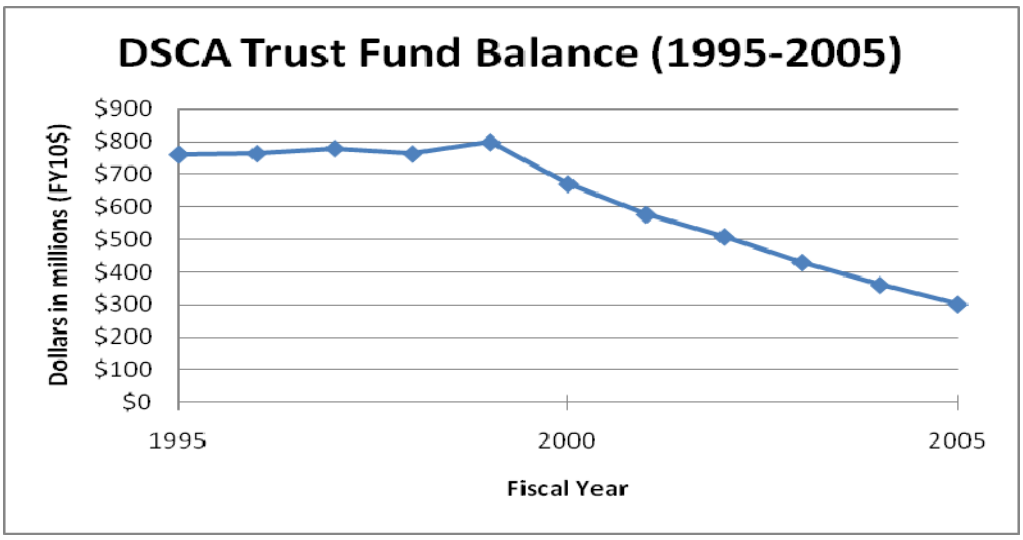


Figure 28. DSCA Trust Fund Balance
(DSCA, 2011)

The actions taken by the DSCSA in regard to the LSC, SLS, and SCML were justified in that they enhanced the business processes of the DSCA and added value to DSCA customers. The LSC was a constant complaint of buying countries, and the guarantee of SLS put the DSCA customer service metrics on par with the business practices of corporate America. The SCML enabled the DSCA to provide proper incentives to customers to minimize the number of small cases, thus lightening the workload of DSCA staff.

Based on the data available today, the 2005 decision to change the surcharge rate to 3.8% was not justified. However, there was no measurable way the DSCA could have anticipated the significant rise in FMS from 2005 to 2010. This FMS increase, coupled with the 3.8% administrative rate, nearly quadrupled the DSCA's original estimates on the status of the FMS–AA in 2010.

The DSCA's internal study produced four options for final consideration:

- Raise the administration rate to 3.8% and implement SLS
- Leave the administration rate at 2.5% and reduce infrastructure costs
- Raise the administration rate to 4.8% and not implement SLS
- Raise the administration rate to 3.8% and apply to all future deliveries

The final decision to raise the rate to 3.8% and implement SLS was based in part on the data presented in Figure 29, which shows the favorable FMS–AA forecast.

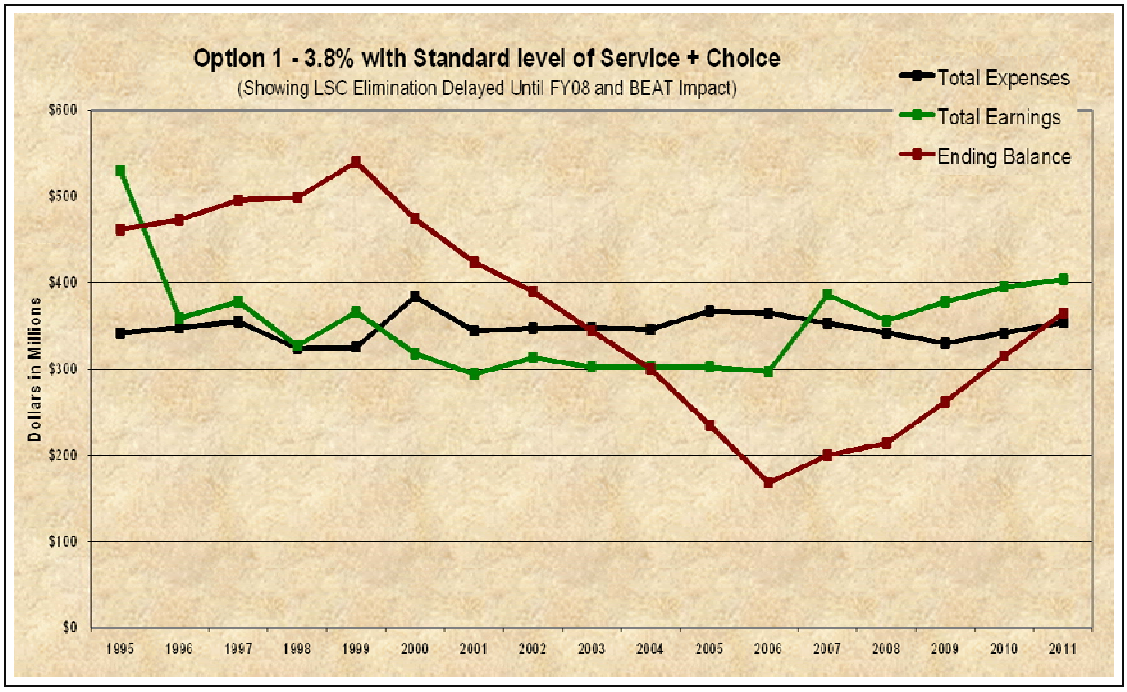


Figure 29. The DSCA's Model to Justify 3.8% and Standard Level of Service
(Webster, 2005, p. 81)

The issue concerning this model comes from the steady rise in the FMS–AA in the projected 2009–2011 years. At the time of the study, this increase in the FMS–AA was seen as a positive because it returned the administrative account to a more desirable level in the eyes of the DSCA; however, it didn't address that a 3.8% administrative surcharge rate would cause the FMS–AA to grow indefinitely. Because the priority in 2005 was to "stop the bleeding" for the FMS–AA, not anticipating the fact that a 3.8% surcharge rate would continue to grow the FMS–AA indefinitely was a flaw in the decision-making process.

While that aspect of the decision was suboptimal, the rest of the internal study used sound methodology and logical reasoning. This thesis attempts to expand upon the DSCA's internal study to produce a result for the DSCA that is more optimal than using a 3.8% surcharge rate. The one major difference between this study and the DSCA's study is that this thesis normalizes all prior FMS and expense data, while the DSCA's study did

not. This is important because as the value of a dollar changes due to inflation, normalizing data allows for an "apples-to-apples" comparison of funding streams over large periods of time.

D. ADMINISTRATIVE SURCHARGE RATE ANALYSIS

1. Framing the Optimal Surcharge Rate

In order to provide a framework for finding the optimal administrative surcharge rate, we conducted a preliminary analysis by analyzing FMS ratios and trends in the FMS–AA.

a. Ratios of FMS to Expenses

The administrative surcharge rate can be examined by doing a comparison of FMS and expenses. From 1984 to 2010, there existed on average per year in the FMS–AA a 2.6% ratio of FMS to expenses. This number is useful in seeing that the current rate of 3.8% is possibly too high, but a lot of stock cannot be put in the 2.6% ratio because it simplifies the collections basis that the DSCA currently uses. The next useful ratio to examine is of FMS from 1984 to 2003 compared to expenses from 1984 to 2010. The reason for the seven-year difference in FMS to expenses is that it takes into account the average case length of approximately seven years. Using that supposition, in 2010, all expenses for a case written in 2003 should be complete. This ratio is 3.2% of FMS to expenses. This ratio also has inaccuracies because it takes into account expenses on FMS for the years 2004–2010. While not ideal, this ratio still provides a useful framework for finding an optimal surcharge rate. These results are summarized in Table 33.

Table 33. Sample Ratios of FMS to Expenses (1984–2010)

Average Per Year Ratio of FMS:Expenses (1984-2010)	Ratio of FMS (1984-2003):Expenses (1984-2010)
2.6%	3.2%

b. Average Yearly Change for the FMS–AA From 1985 to 2010

The next step in the preliminary analysis was examining how past changes in the administrative surcharge rate affected the volatility of the trust fund.

Table 34. Average Yearly Change in the FMS–AA From 1985 to 2010

	Average Yearly % Change in FMS-AA
1985-1999 (3.0%)	28.2%
2000-2005 (2.5%)	-12.8%
2006-2010 (3.8%)	49.3%

One of the DSCA's goals is to find an administrative surcharge rate that causes minimal volatility on the FMS–AA. As can be seen in Table 34, the ideal range for the surcharge rate is somewhere between 3.8% and 2.5%. While this range is imprecise, this data is helpful in framing what is an optimal surcharge rate. The data in Table 34 shows that 3.8% is too high because it causes an almost 50% increase in trust fund balance per year, while at the same time 2.5% causes an annual decrease on average of 12%. Because the goal is to maintain a small growth in the FMS–AA, the answer lies somewhere in between these two values.

2. Historical Modeling of the FMS–AA From 1999 to 2010

Using the anticipated earnings model, Figure 30 shows the modeled status of the FMS–AA in 2010 by applying different sample rates in 1999. It answers the question, If I had applied administrative rate *x* in 1999, the status of the account today would be *y*. Modeled values are compared to the actual FMS–AA balance, which is shown as a dashed line.

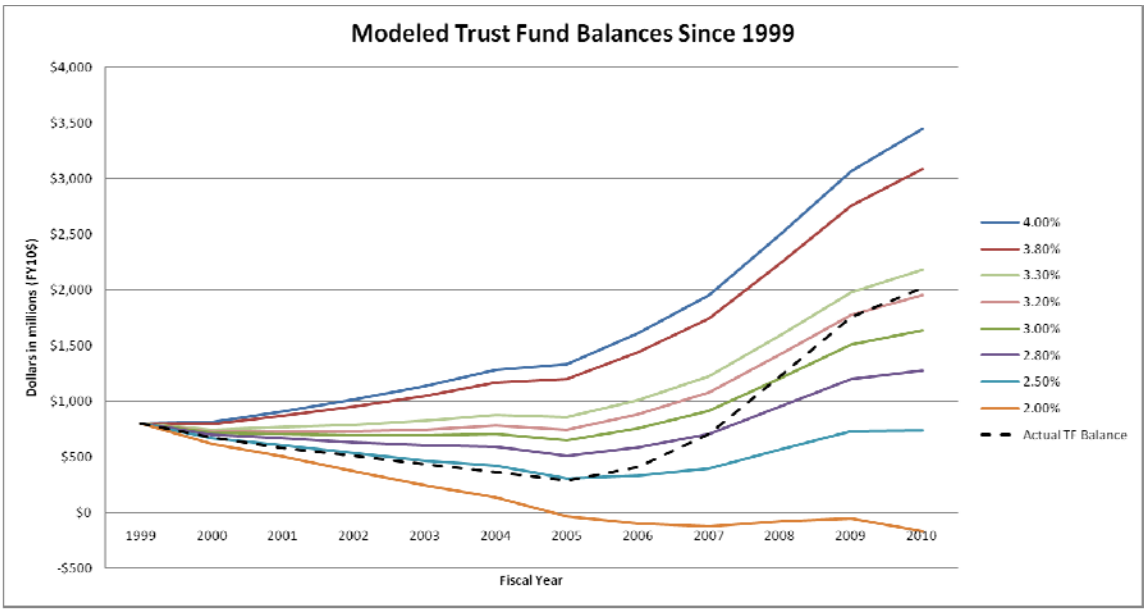


Figure 30. DSCA Trust Fund Using the Anticipated Earnings Model (1999–2010)

Figure 30 presents several results that are important. First, if 3.8% had been applied in 1999, the FMS–AA in 2010 would be at just over $3 billion, a $1 billion increase over the FMS–AA's current 2010 status. This trend clearly shows that a 3.8% administrative rate is too high. During the lower sales years of 1999 to 2005, where average sales were $16.3 billion as compared to $31.6 billion average sales from 2006 to 2010, the FMS–AA increased just under 50% per year using a 3.8% administrative rate. Also, if the DSCA had left the rate at 2.5% in 2005, the FMS–AA would not have gone insolvent, as originally anticipated. This, however, is not due to bad planning by the DSCA but due to the unanticipated significant sales increase from 2006 to 2010.

Table 35 shows the average yearly percent change in the ending balance of the trust fund using the anticipated earnings model for two different time periods: the stable sales years of 1999 to 2005 and the accelerated sales years of 2006 to 2010. While not conclusive, this table suggests an ideal range between 3.0–3.4% for the administrative surcharge rate because this range minimizes excessive FMS–AA fluctuations over two different sales scenarios.

Table 35. FMS–AA Balance Changes Using the Anticipated Earnings Model

	1999-2005	2006-2010
4.00%	9.0%	21.0%
3.80%	7.1%	21.0%
3.40%	2.5%	20.8%
3.30%	1.2%	20.8%
3.20%	-1.0%	21.5%
3.10%	-1.7%	20.7%
3.00%	-3.3%	20.6%
2.80%	-7.0%	20.4%
2.50%	-14.6%	20.1%
2.00%	-45.9%	-68.5%

E. FMS–AA OUTLOOK FROM SIMULATIONS

1. Simulated Five-Year Future FMS–AA Models 2011–2015

Using the anticipated earnings model, it was possible to conduct simulations of the FMS–AA through 2015. These simulations used four FMS and two expense models.

a. Future FMS Models

While described in-depth in Chapter III, the following are the different scenarios that were modeled.

(1) Aggressive FMS Growth: This model used the DSCA's most optimistic sales forecasts. This model is based on historical precedence and has a less than 15% chance of occurring, assuming FMS is normally distributed.

(2) Reduced FMS: This model used the average of FMS from 1995 to 2005. Similar to the Aggressive FMS Growth model, this model also has a less than 15% chance of occurring, assuming FMS is normally distributed.

(3) 2010 FMS Levels: This model used 2010's FMS in each of the simulated future years.

(4) Monte Carlo Simulations: We developed two Monte Carlo models using different implementation methods. Because both models gave very similar results for future simulated FMS, results are presented as one model. Monte Carlo

models statistically have a 68% chance of occurrence, assuming FMS distribution is normal.

b. Future Expense Models

Two models were used to determine future expenses. The cost driver model is based on linear growth in expenses while the flat expense model is currently used by the DSCA.

(1) Cost Driver Expense Model: These expenses are based on cost drivers developed earlier in this thesis. For our Cost Driver Expense model, we decided to use our DSCA Work Years model to estimate DSCA's future expenses based on work years. We forecasted future work years by applying linear regression to civilian and contractor work year data from 2007 to 2010. We then calculated future expenses using the budget estimating relationship for our DSCA Work Years model. Figure 31 illustrates our forecasted expenses for 2011 to 2015. Notice that this model represents an aggressive expense scenario.

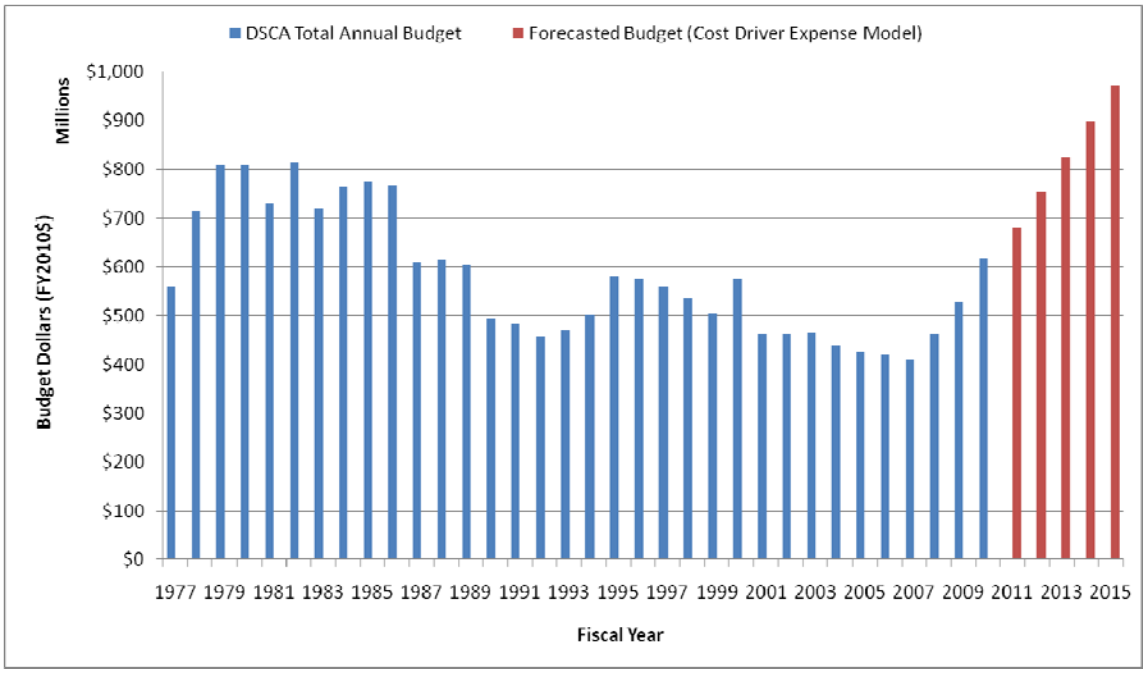


Figure 31. Cost Driver Expense Model—Aggressive Budget Forecast

(2) Flat Expense Model: This model uses FY2011 funding levels applied every year for the next five years. This is a more conservative model and presumes that costs in constant dollars have peaked and will remain the same for the next 5 years. The DSCA currently uses static expense models for future projections. Figure 32 illustrates the Flat Expense model. This model represents our conservative expense scenario.

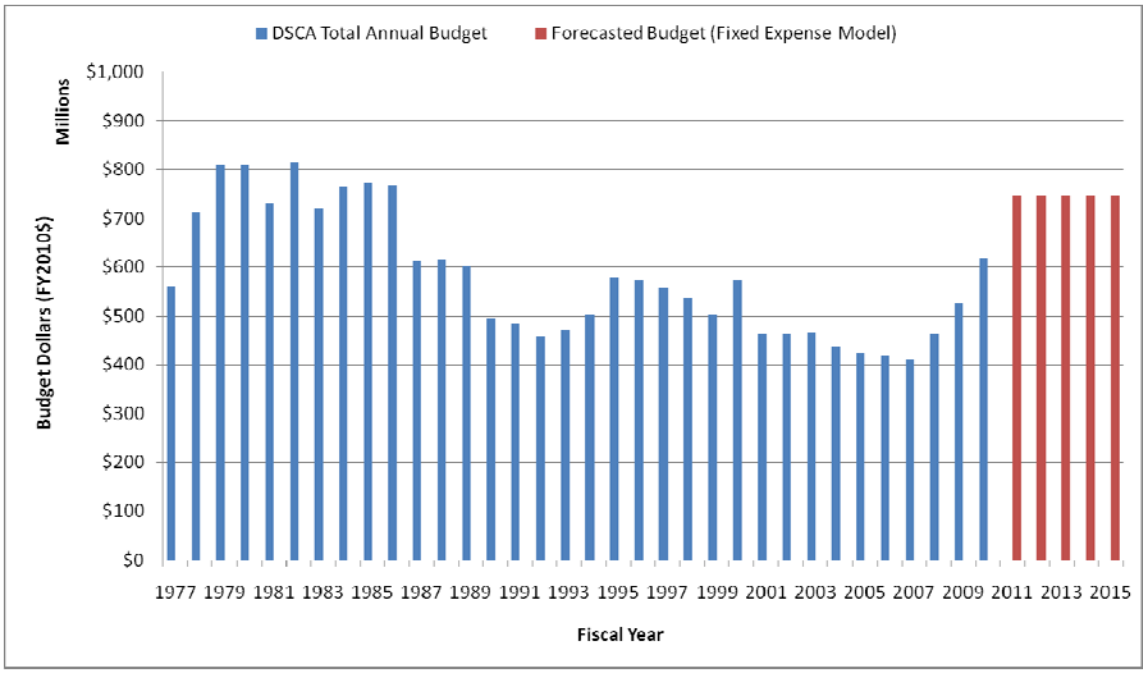


Figure 32. Flat Expense Model—Conservative Budget Forecast

Table 36 summarizes the FMS and expense models used in the five-year simulations. See Chapter III for details on how values were derived.

Table 36. Five Year Simulation Values for Different FMS and Expense Models ($Millions)

Model	FY11	FY12	FY13	FY14	FY15
Sales					
Aggressive FMS Growth	$46,407	$52,375	$58,344	$64,312	$70,280
Reduced FMS	$15,758	$15,758	$15,758	$15,758	$15,758
2010 FMS Level	$31,758	$31,758	$32,305	$33,049	$33,809
Monte Carlo	$26,448	$25,870	$25,547	$26,561	$26,339
Expenses					
Cost Driver Expense Model	$681	$754	$826	$899	$972
Flat Expense Model	$750	$750	$750	$750	$750

2. Status of FMS–AA in 2015

All four future FMS and the two expense models were inputted into the anticipated earnings model to produce simulated results of the trust fund balance in 2015. Table 37 shows the status of the FMS–AA in five years using these simulations. 3.0–3.4% administrative rates are highlighted in yellow because that is the target range based on preliminary analysis to find the optimal administrative surcharge rate.

Table 37. FMS–AA Ending Balances in 5-Years Based on Different Prediction Methods ($Millions)

Expense Model: Cost Drivers

	Aggressive FMS	2010 FMS Level	Reduced FMS	Monte Carlo
2.00%	$2,691	$1,174	$147	$787
2.50%	$3,570	$1,673	$390	$1,190
2.80%	$4,097	$1,973	$535	$1,432
2.90%	$4,273	$2,073	$584	$1,512
3.00%	$4,449	$2,173	$633	$1,593
3.10%	$4,624	$2,272	$681	$1,674
3.20%	$4,800	$2,372	$730	$1,754
3.30%	$4,976	$2,472	$778	$1,835
3.40%	$5,152	$2,572	$827	$1,915
3.80%	$5,855	$2,972	$1,021	$2,238
4.00%	$6,206	$3,171	$1,118	$2,399

Expense Model: Flat

	Aggressive FMS	2010 FMS Level	Reduced FMS	Monte Carlo
2.00%	$3,072	$1,555	$528	$1,169
2.50%	$3,951	$2,054	$771	$1,571
2.80%	$4,478	$2,354	$917	$1,813
2.90%	$4,654	$2,454	$965	$1,894
3.00%	$4,830	$2,554	$1,014	$1,974
3.10%	$5,006	$2,654	$1,062	$2,055
3.20%	$5,181	$2,754	$1,111	$2,135
3.30%	$5,357	$2,853	$1,160	$2,216
3.40%	$5,533	$2,953	$1,208	$2,297
3.80%	$6,236	$3,353	$1,402	$2,619
4.00%	$6,587	$3,553	$1,499	$2,780

The results in Table 37 have some data worth noting. The aggressive FMS model causes the FMS–AA to double or triple in size. While this model only has a 15% chance

of occurrence, this result is undesirable for the DSCA. If sales remain at their FY2010 levels, the FMS–AA could increase upwards of another $1 billion depending on the rate. Lastly, using the Monte Carlo future FMS and the cost driver expense model, the FMS–AA would reduce to $1.5–2.0 billion using rates of 3.0–3.4%. Using the flat expense model, the same rates would produce an FMS–AA between $2.0–2.3 billion.

3. FMS–AA Year-By-Year Simulation Results

The next section describes the year-by-year results of the previous 2011 to 2015 simulation models. The Monte Carlo simulation FMS presents probability distributions for possible outcomes over multiple iterations (using normally distributed FMS), and those results are presented first. Figure 33 depicts the Monte Carlo simulations for the FMS-AA using the cost driver expense model, where expenses increase linearly through five years. Figure 34 depicts the same simulated FMS using a flat expense model assuming fixed expenses from 2011 through 2015.

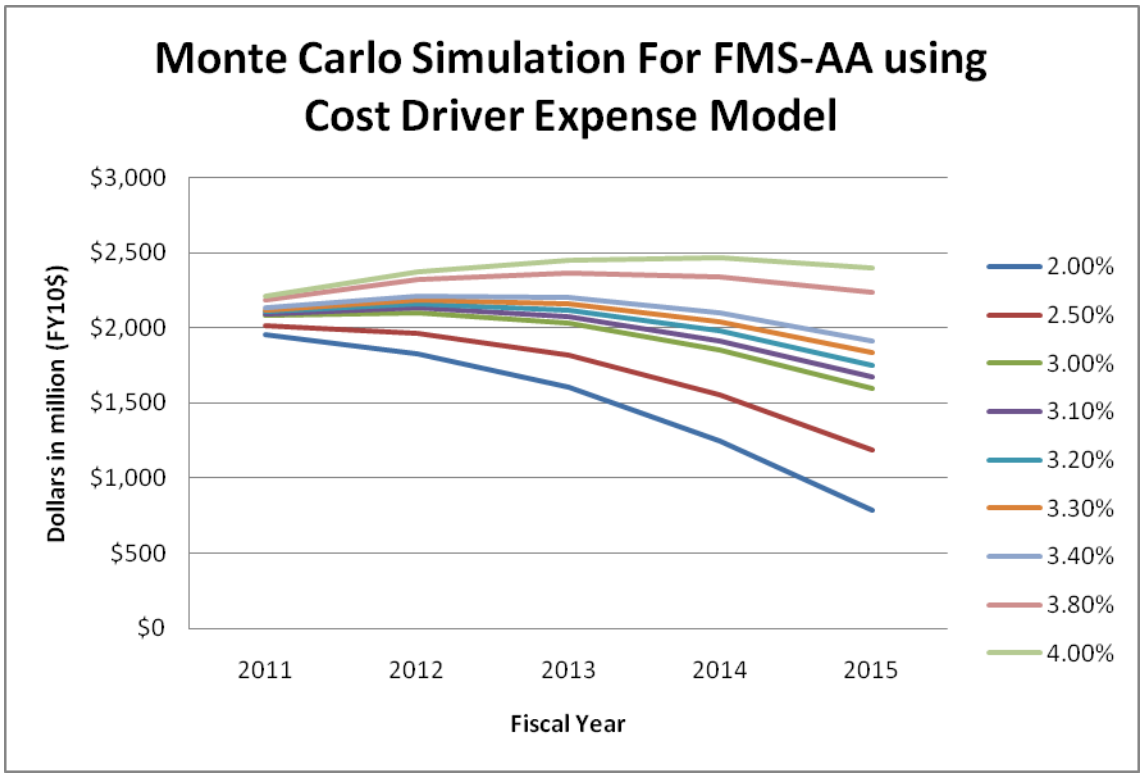


Figure 33. Monte Carlo Simulation for FMS–AA Using Cost Driver Expense Model

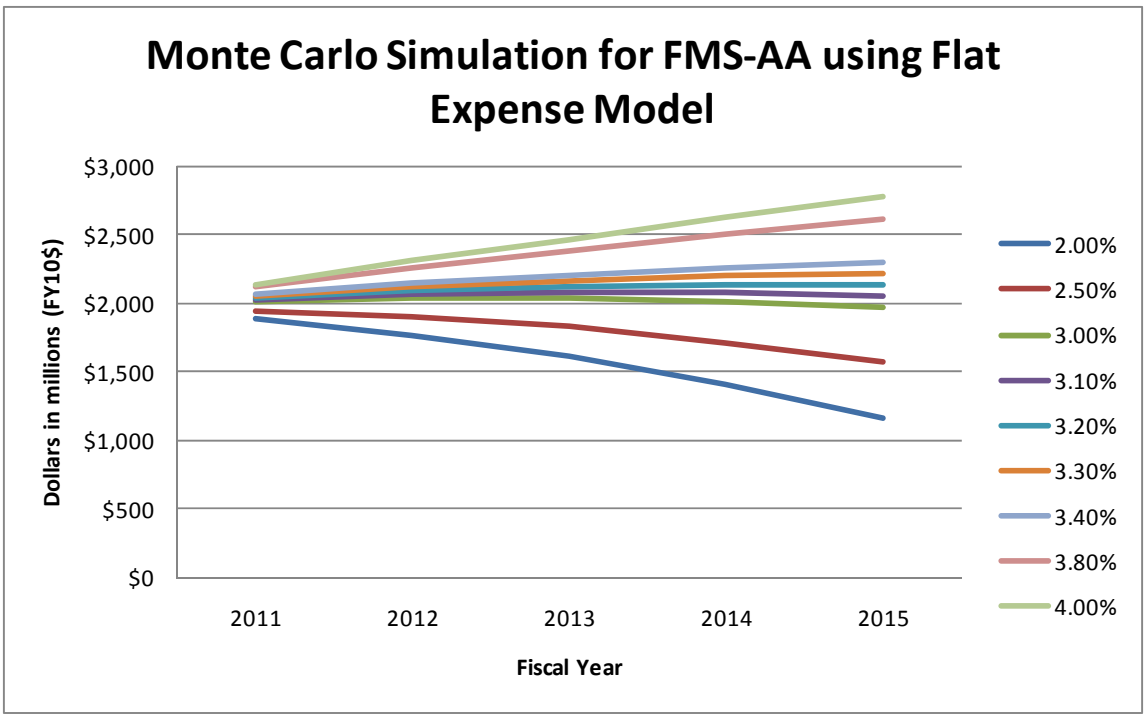


Figure 34. Monte Carlo Simulation for FMS–AA Using Flat Expense Model

Results from the Monte Carlo simulations are quite different depending on which expense model is used. Using the cost driver expense model, any applied administrative rate below 3.8% causes the FMS–AA to decrease by 2015. This is because the cost driver model causes expenses to increase by 42% over five years. Since FMS stays relatively flat year by year using the Monte Carlo simulation, it naturally leads to a decrease in the FMS–AA. Compared to the cost driver expense model, the flat expense model produces a more stable FMS–AA from 2011 to 2015. Administrative rates of 3.0% to 3.4% generate very small changes to the FMS–AA. At a 3.0% administrative rate, the FMS–AA decreases by -2% over five years, while a 3.4% administrative rate causes the FMS–AA to gain 11% over five years.

Figure 35 presents the rest of the year-by-year FMS and expense forecast models.

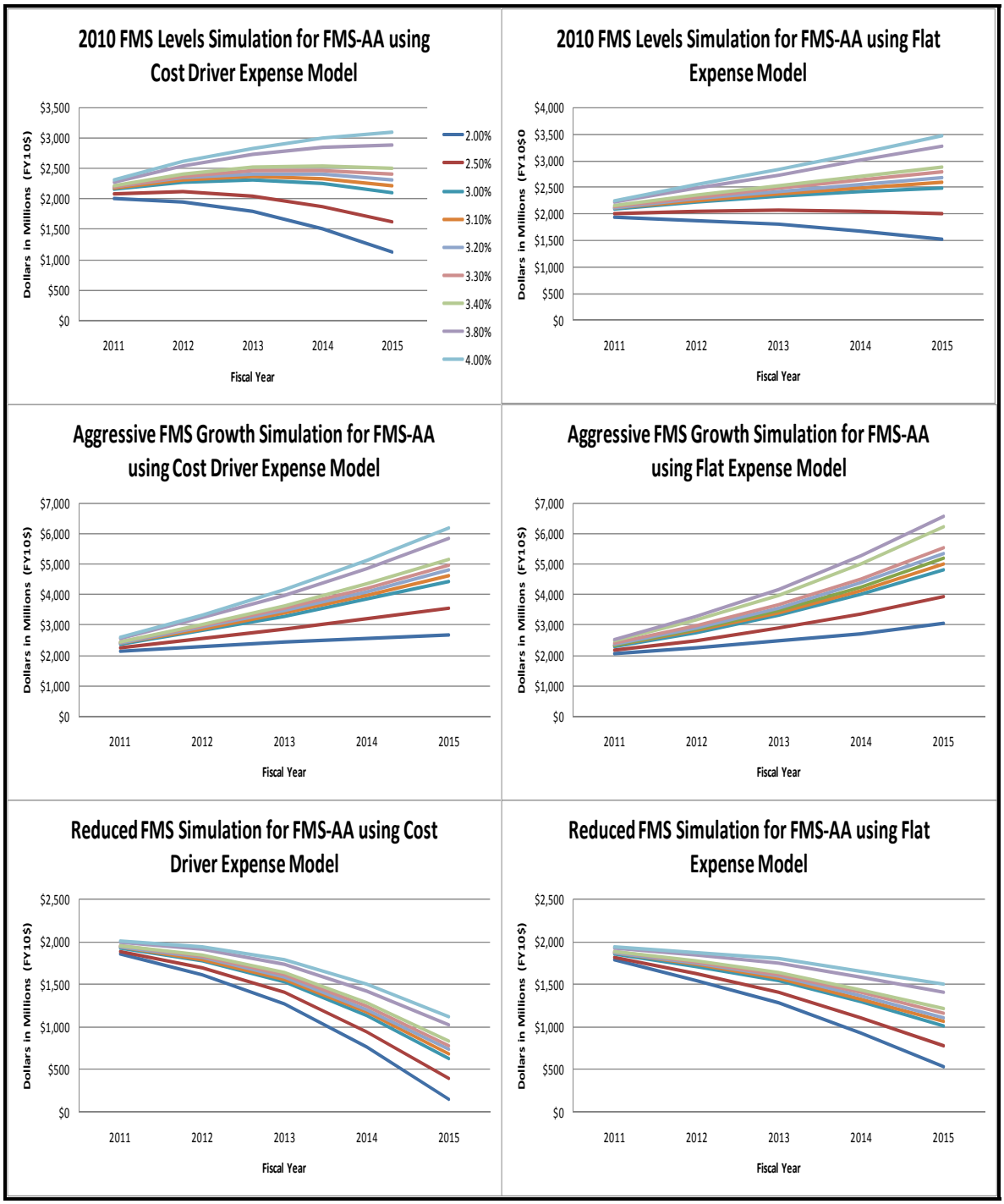


Figure 35. 2011–2015 Year-by-Year Simulations for the FMS–AA

4. Sensitivity Analysis of Simulation Data

The Monte Carlo model has an advantage over the other FMS models because Monte Carlo simulations provide probability distributions for possible outcomes. Table

38 uses the results of the Monte Carlo model to estimate the probability that the FMS–AA in 2015 will fall below a certain threshold. For example, applying a 3.0% administrative rate and using the cost driver expense model, the probability of being below $828 million in five years is 5.56%.

We chose the threshold value of $734 million because it is the 2010 FMS–AA safety level developed by the DSCA, whereas $828 million is the projected safety level in 2015. The $0 and $1,000 threshold values were used because they provide boundaries for analysis. 3.0–3.4% are highlighted again based on preliminary analysis. Chapter III has a deeper examination on how these values were derived.

Table 38. Monte Carlo Sensitivity Analysis: Chances That the FMS–AA in 2015 Is Below a Threshold Value

Expense Model: Cost Drivers

$(MIL)	$0	$734	$828	$1,000
2.0%	0.7%	42.8%	54.2%	73.8%
2.5%	0.2%	12.4%	18.2%	31.3%
2.8%	0.1%	6.0%	8.9%	16.8%
3.0%	0.1%	3.7%	5.6%	10.9%
3.1%	0.0%	3.0%	4.4%	8.6%
3.2%	0.0%	2.4%	3.6%	7.0%
3.3%	0.0%	1.9%	2.9%	5.8%
3.4%	0.0%	1.5%	2.3%	4.8%
3.8%	0.0%	0.7%	1.1%	2.1%
4.0%	0.0%	0.5%	0.8%	1.5%

Expense Model: Flat

$(MIL)	$0	$734	$828	$1,000
2.0%	0.0%	8.6%	14.1%	29.3%
2.5%	0.0%	1.8%	3.1%	7.5%
2.8%	0.0%	0.8%	1.5%	3.6%
3.0%	0.0%	0.5%	0.9%	2.1%
3.1%	0.0%	0.4%	0.7%	1.7%
3.2%	0.0%	0.3%	0.5%	1.4%
3.3%	0.0%	0.3%	0.4%	1.1%
3.4%	0.0%	0.2%	0.4%	0.9%
3.8%	0.0%	0.1%	0.2%	0.4%
4.0%	0.0%	0.1%	0.1%	0.3%

Sensitivity Analysis of Monte Carlo results re-affirms earlier findings. First, a surcharge rate of 2.5% or below carries a high risk that the FMS–AA will not meet 2011 to 2015 designated safety levels, while a rate of 3.8% or higher demonstrates a reduced risk of going below safety levels. As discussed previously, the 3.0–3.4% surcharge range appears to meet all desired constraints of low variability with reduced risk. At the most

extreme, there is only a 5.6% chance using a 3.0% administrative rate that the FMS–AA in 2015 will be below the projected 2015 safety level.

Table 39 presents sensitivity analysis from a different perspective. This table demonstrates the probability that the FMS–AA in 2015 will surpass a certain threshold based on a given administrative rate. For example, using the cost driver expense model, one can see that at 3.0% there is a 20.4% chance that the FMS–AA in 2015 will be above $2 billion, but using 3.4%, that probability more than doubles to 44.3%. Threshold values were picked by incrementing the 2010 FMS–AA level by $500 million.

Table 39. Monte Carlo Sensitivity Analysis: Chances That the FMS–AA in 2015 Will Be Above a Threshold Value

Expense Model: Cost Drivers

$(MIL)	$2,000	$2,500	$3,000	$3,500
2.0%	0.01%	0.00%	0.0%	0.0%
2.5%	2.32%	0.06%	0.0%	0.0%
2.8%	10.60%	0.93%	0.0%	0.0%
3.0%	20.4%	3.2%	0.2%	0.0%
3.1%	26.2%	5.2%	0.4%	0.0%
3.2%	32.0%	7.5%	0.8%	0.0%
3.3%	38.4%	11.0%	1.5%	0.1%
3.4%	44.3%	14.5%	2.4%	0.2%
3.8%	65.2%	33.42%	11.0%	2.0%
4.0%	73.2%	44.34%	17.8%	4.4%

Expense Model: Flat

$(MIL)	$2,000	$2,500	$3,000	$3,500
2.0%	0.55%	0.00%	0.0%	0.0%
2.5%	14.95%	1.14%	0.0%	0.0%
2.8%	34.82%	6.73%	0.5%	0.0%
3.0%	48.1%	14.1%	1.8%	0.1%
3.1%	55.0%	18.8%	3.0%	0.2%
3.2%	60.9%	24.3%	4.8%	0.4%
3.3%	65.9%	30.0%	7.2%	0.8%
3.4%	70.7%	36.2%	10.3%	1.5%
3.8%	84.6%	57.95%	26.8%	7.8%
4.0%	88.7%	67.31%	37.0%	13.2%

High threshold sensitivity analysis demonstrates the differentiation in risk for the 3.0–3.4% administrative surcharge range. Using the flat expense model, at 3.0%, there is

only a 1.8% chance that the FMS–AA will be above $3 billion in 2015, while at 3.4%, that risk is increased to 10.3%, which is roughly a five times increase in risk. Since the DSCA finds it undesirable to have an FMS–AA that has a large balance, it is important to consider the risk of letting the FMS–AA go above threshold values.

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V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

Our study provides a financial analysis and assessment of the DSCA business operations by addressing the following research questions:

(1) What is the DSCA's general cost structure?

(2) What are the relevant cost drivers for administering the FMS program?

(3) Was the 2005 Fees Study Group analysis well-founded?

(4) What is the optimal administrative surcharge rate to ensure the long-term solvency of the FMS Trust Fund?

1. Cost Structure

The cost of administering the FMS program is predominantly due to personnel-related and contractor costs. An analysis of the DSCA's budget execution by object class from 2005 to 2010 revealed that over 90% of their costs are due to personnel labor costs and contractual services. Less than 10% of the DSCA's expenses were dedicated to all other expenses and overhead, to include rent, communication, utilities, travel, transportation, printing, supplies, and equipment. Thus, DSCA can be characterized as a labor intensive, rather than a capital intensive organization.

From 2005 to 2010, DSCA also demonstrated rising trends in both contractor services and average cost of work years. Since 2005, contractor work years as a share of total work years have increased 125%. With the growing contractor support, the average work year cost has increased 12.4%. If these trends continue, these factors will compound the increase in total budget requirements.

2. Relevant Cost Drivers

Regression analysis consistently found the number of LORs completed during the FY (#LOR) to be the most significant cost driver for both the DSCA and the MILDEPs. The emergence of #LOR as the best explanatory variable for predicting workload and

budgets suggests that quantity drives workload more than dollar-values drive workload. While all of our models demonstrate strong statistical significance, low p-values and high R-square values do not always lead to practical explanatory power. The DSCA should consider the experienced input of IAs to ascertain additional factors and intangibles that may affect workload and resource requirements. It is also important to note that these budget forecasting models predict budgets based on past funding levels using budget execution data, and do not indicate what funding levels should be allocated based on actual costs.

a. Budget Estimating Relationships

Using parametric cost-estimating techniques and regression analysis, we formulated models that estimate workload and budget requirements. We developed three budget estimating models that predicted workloads and budgets for DSCA as a whole and also at the MILDEP level. Table 40 provides a model summary for our three accepted estimating relationships.

Table 40. Budget Estimating Relationships—Model Summary

Model	Dependent Variable	Explanatory Variable	R-square	adjusted R-square	Standard Error	*F*	*F-significance*	MAPE
DSCA Work Years	DSCA Budget (FY10$M)	Civilian W/Y + Contractor W/Y	0.985	0.981	11.2	265.84	0.00	1.57%
DSCA Cost Factor	Civilian W/Y + Contractor W/Y	#LOR	0.973	0.966	73.6	143.74	0.00	1.36%
MILDEP Cost Factor	MILDEP Budget (FY10$M)	#LOR	0.914	0.905	16.62	96.04	0.00	4.53%

Both cost factor models tested the following six explanatory variables for statistical significance: #LOR, #LOA, #TOC, $Admin, $Sales, and $TOC. Our model acceptance criteria was based on a 95% confidence level and R-square values greater than 0.80. Additionally, we preferred models without multi-collinearity (correlation coefficient < 0.70) and with mean absolute percentage errors less than 5%.

(1) DSCA Work Years Model. Our first model uses the sum of civilian and contractor work years as the cost driver for estimating the DSCA's annual operating budget. The sum of civilian and contractor work years explained 98.5% of the

variability in the DSCA's budget from 2005 to 2010 and estimated the actual budget with a MAPE of 1.57%. Our DSCA Work Years model budget estimating relationship is shown in Equation 12.

$$DSCA\ Budget\ (FY10\$M) = 0.2042\ (Civilian\ W/Y + Contractor\ W/Y) - 203.64 \quad (12)$$

(2) DSCA Cost Factor Model. Our second model uses the number of LORs completed during the FY (#LOR) as the cost driver for predicting civilian and contractor work year requirements. #LOR explained 97.3% of the variability in civilian and contractor work years from 2005 to 2010 and estimated the sum of work years with a low MAPE of 1.36%. The work years estimating relationship for the DSCA Cost Factor model is shown in Equation 13.

$$(Civilian\ W/Y + Contractor\ W/Y) = 0.4802\ (\#LOR) - 163.35 \quad (13)$$

(3) MILDEP Cost Factor Model. Our third model uses the number of LORs completed during the FY (#LOR) as the cost driver for estimating the MILDEP funding levels. #LOR explained 91.4% of the variability in the MILDEP funding levels from 2000 to 2010 and estimated the budget with a MAPE of 4.53%. The budget estimating relationship for our MILDEP Cost Factor model is presented in Equation 14.

$$MILDEP\ Budget\ (FY10\$M) = 0.07613\ (\#LOR) - 205.14 \quad (14)$$

b. Other Considerations

In the absence of actual cost data, this study analyzed budget data to provide a better understanding of the DSCA's cost structure and reveal notable trends in their business operations. Whereas our models are based on historical funding levels, all three estimating relationships demonstrated high statistical significance (R-squares

greater than 0.90) and may be useful to the DSCA to make future resourcing decisions. However, in the end, there is no definitive cost driver without actual cost data.

Additionally, the DSCA should monitor the rising trend in the number of open cases. In 2001, the #TOC exceeded the #LOR for the first time and will continue to surpass the #LOR each year. The cumulative effect of #TOC compounds the workload requirements because case managers must administer new LORs and LOAs each year in addition to managing the growing number of open cases. The continued accumulation of open cases will undoubtedly have implications for DSCA's future workload and budgeting requirements.

3. The DSCA's 2005 Internal Study

The DSCA's 2005 internal study was well-founded and used sound methodology in establishing the 3.8% administrative surcharge rate. At the time it was impossible for the DSCA to predict the significant increase in FMS from 2006 to 2010, which caused the FMS–AA to reach record levels. For future assessments, we recommend that the DSCA normalize all historical FMS financial data, which allows for a more equitable comparison of financial data. The greatest shortcoming of the study was perhaps their failure to address the rising trend of the trust fund balance using a 3.8% surcharge rate. While the study demonstrated that 3.8% would bring the FMS trust fund balance back into solvency, the forecasts also showed sustained growth in the trust fund balance that would continue beyond their required safety levels. Finally, the years of the study from 1995 to 2005 represented an uncharacteristic period of sustained low levels of FMS. Because the DSCA ensures the long-term solvency of the trust fund, future studies should consider the historic FMS average over a longer time series.

4. Administrative Surcharge Rate

Based on our analysis, we recommend that the DSCA use 3.0% as its FMS administrative surcharge rate. This thesis examined the FMS–AA by modeling historical data as well as forecasting the FMS–AA from 2011 to 2015. Whereas other possible solutions exist, this thesis research supports 3.0% as the best rate in the current environment. Analysis of this research is summarized as follows.

- From 1977 to 1999, the DSCA used 3.0% as their administrative surcharge rate with some success. Average growth rate per year was 28.2% for the ending balance of the FMS–AA. It could be argued that because the DSCA changed the surcharge rate from 3.0% to 2.5% in 1999 that the 3.0% rate was invalid. This, however, was not the case, because invalid assumptions about future events dictated the 1999 rate change. A 1999 GAO report revealed the same conclusion in *Defense Trade: Decision to Lower FMS Administrative Fee is Premature* (GAO, 1999a).
- Using the anticipated earnings model, a 3.0% administrative rate applied to 1999–2010 historical FMS data demonstrated a -3.3% average change per year in the FMS–AA ending balance from 1999 to 2005 and an average 7.6% per year growth from 1999 to 2010. -3.3% is not a cause for concern because the average FMS from 1999 to 2005 was $16.3 billion, which is below the historical average of $26 billion FMS. If FMS continues with the present high rate of growth, 3.0% mitigates the excessive gain in the FMS–AA.
- Using Monte Carlo forecasting models, which provide probability distributions for possible outcomes, we simulated FMS from 2011 to 2015. An applied 3.0% administrative rate using the cost driver expense model demonstrated the FMS–AA decreasing at an average of 6.3% a year, while the same scenario using a flat expense model demonstrated the FMS–AA decreasing only 0.5% per year.
- Both the aggressive FMS growth and reduced FMS models have a less than 15% chance of occurring, assuming FMS is normally distributed. In both cases, a 3.0% administrative rate would still work, albeit not optimally. In the aggressive FMS model, a 3.0% rate would grow the FMS–AA in 2015 to $4.8 billion, while in the reduced FMS sales model, the FMS–AA would decrease to $1 billion. In both of these cases, different administrative rates would produce more optimal results for the FMS–AA; however, because the DSCA's objective is to minimize the changes in surcharge rates, 3.0% would still be acceptable.
- While 3.0% is a solid recommendation, a case could be made for choosing a rate within the range of 3.0% to 3.4%, using the same arguments mentioned previously. The most optimal solution within this range is 3.0% because it mitigates the risk of the FMS–AA getting too large. All rates in the 3.0% to 3.4% range using sensitivity analysis demonstrate less than 6% probability of the FMS–AA falling below pre-determined safety levels by 2015. However, 3.0% does the best job of mitigating the risk of the FMS–AA getting too large if increased FMS continue. If FMS stabilize at the highest probability FMS levels from our Monte Carlo model at roughly $25.5 billion, 3.0% minimizes the fluctuations in the FMS–AA compared to any other rate.

B. SUGGESTIONS FOR FUTURE RESEARCH

This section recommends areas of research for further study and evaluation. As we conducted our analysis, we identified the following areas for future research efforts.

- Collections Curve Smoothing. This research is based on the notion that "smoothing" out the collections curve could possibly bring more stability to the FMS–AA. For most FMS cases, the DSCA collects 50% of the surcharge up front in the first year. The question arises on whether there is a matching problem with revenues and expenses. In other words, is 50% of the workload conducted in the first year? Future research could evaluate this current policy and examine alternative collection schedules. For example, collecting 30% the first year and 20% the second year. A flatter collections curve may reduce the risk of the Administrative Trust Fund dropping below acceptable levels during a single low sales year. This research would test the hypothesis that a smoother collections curve would result in more stability to the FMS–AA.
- Tiered Pricing Structure. The DSCA recently implemented a tiered pricing structure for FMS cases that exceeds $9 billion. Above $9 billion, the DSCA would discount the administrative surcharge rate by 1%. This thesis did not address the effects of this new tiered pricing policy. This policy would help mitigate the excess funds collected on the highest dollar-value cases. Future research would address the effect of this policy on future revenues and potentially expand on the applicability of a more comprehensive tiered pricing structure.
- Lagging Effect. Historical data indicates a two-year lag between increased sales and increased budgets. The lagging effect accounts for the time required to implement policies and adjust to changing workload requirements. For example, how long does it take the DSCA to add required work years in response to increased workload? Future research could offset relevant data by one or two years and re-evaluate for significant cost factors. Additionally, the use of contractors may provide less lag.
- Number of Cases Closed Each Year. This is another cost factor to consider in future research because closing cases also requires certain levels of workload. The DSCA recognizes the importance of reconciliation and case closure. GAO reports indicate that inadequate administrative funding results in the inability of MILDEPs to close cases in a timely manner and that "slow case closures have been the subject of FMS customer complaints" (GAO, 1999b, p. 9–10). Case closure data will also allow comparisons between the rates of new case implementation versus the rates of case closure and help identify trends in the growing number of open cases.

- Service-Specific Models. This research would examine the cost structure and budget estimating models at the three main Service levels—Army, Navy, and Air Force. By collecting historical data from each specific IA, this research could identify cost drivers unique to each military department and reveal differences across Services.

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LIST OF REFERENCES

The American Presidency Project. (1976). *Gerald Ford: Statement on signing the International Security Assistance and Arms Export Control Act of 1976*. Retrieved from http://www.presidency.ucsb.edu/ws/index.php?pid=6167

Baker, B. (2005a). *Fees group briefing–Final version–21 June 05*. PowerPoint presentation at the meeting of the Defense Security Cooperation Agency (DSCA), Arlington, VA.

Baker, B. (2005b). *Restructure of FMS charges, frequently asked questions*. PowerPoint presentation at the meeting of the Defense Security Cooperation Agency (DSCA), Arlington, VA.

Baker, B. (2006, Winter). Changes to foreign military sales administrative surcharge structure and rate. *The DISAM Journal of International Security Assistance Management*, *28*(2), 1–8.

Baker, B. (2010a). *Administrative surcharge–State Department 2010*. PowerPoint presentation at the meeting of the Defense Security Cooperation Agency (DSCA), Arlington, VA.

Baker, B. (2010b). *FY00–FY10 data on cases and dollar value–December 2010*. PowerPoint presentation at the meeting of the Defense Security Cooperation Agency (DSCA), Arlington, VA.

Davis, B. (2002/2003). Performance based costing. *The DISAM Journal*, 118–124. Retrieved from http://www.disam.dsca.mil/pubs/v.25_1&2/Davis,%20Bobby,%20Dr.pdf

Defense Institute of Security Assistance Management (DISAM). (n.d.). *Security assistance management orientation course*. Retrieved from http://www.disam.dsca.mil/DISAM1/EXTERNAL%20LINKS/sam-oc.asp

Defense Institute of Security Assistance Management (DISAM). (2010, January). *The management of security assistance*. Retrieved from http://www.dsca.osd.mil/pubs/29th%20Gbookv2.pdf

Defense Security Cooperation Agency (DSCA). (n.d.a). DSCA overview. Retrieved from http://www.dsca.osd.mil/about_us.htm

Defense Security Cooperation Agency (DSCA). (n.d.b). The FMS advantage: Frequently asked questions. Retrieved from http://www.dsca.osd.mil/about_us.htm

Defense Security Cooperation Agency (DSCA). (n.d.c). Foreign military sales. Retrieved from http://www.dsca.osd.mil/home/foreign_military_sales.htm

Defense Security Cooperation Agency (DSCA). (n.d.d). *Foreign military sales financial management*. PowerPoint presentation at the meeting of the Defense Security Cooperation Agency (DSCA), Arlington, VA.

Defense Security Cooperation Agency (DSCA). (n.d.e). How does FMS operate? Retrieved from http://www.dsca.osd.mil/PressReleases/faq.htm#How%20Does%20FMS%20Operate

Defense Security Cooperation Agency (DSCA). (n.d.f). Organization center by directorate. Retrieved from http://www.dsca.osd.mil/business_center.htm

Defense Security Cooperation Agency (DSCA). (2003, October 3). *Security assistance management manual* (*SAMM*; DoD 5105.38-M). Retrieved from http://www.dsca.mil/samm/

Defense Security Cooperation Agency (DSCA). (2010a). Enterprise planner database. Retrieved from https://sc-ppbe.dsca.mil

Defense Security Cooperation Agency (DSCA). (2010b, August). DSCA organization [chart]. Retrieved from http://www.dsca.osd.mil/organization.htm

Defense Security Cooperation Agency (DSCA). (2011, January). *DSCA Comptroller and Financial Policy and Internal Operations (FPIO) data.* Retrieved from DSCA site visit in Arlington, VA and email communications.

Department of Defense (DoD). (2001, April 12). *Department of Defense dictionary of military and associated terms* (Joint publication [JP] 1–02). Retrieved from http://www.dtic.mil/doctrine/new_pubs/jp1_02.pdf

Department of Defense (DoD). (2004, August). *Foreign military sales case reconciliation and closure manual* (*RCM*; DoD 5105.65-M). Retrieved from http://www.dsca.mil/rcm/

Department of Defense Inspector General (DoDIG). (2009, March). *Funds appropriated for Afghanistan and Iraq processed through the foreign military sales trust fund (*D-2009-063). Retrieved from http://www.dodig.mil/Audit/reports/fy09/09-063.pdf

Elliott, D. (2009, May) A guide to the Pension Benefit Guaranty Corporation. *Brookings Institute*. Retrieved from http://www.brookings.edu/~/media/Files/rc/papers/2009/0520_pensions_elliott/0520_pensions_elliott.pdf

Government Accountability Office (GAO). (1999a, May). *Defense trade: Decision to lower FMS administrative fee is premature* (GAO/NSIAD-99-161R). Retrieved from http://www.gao.gov/products/NSIAD-99-161R

Government Accountability Office (GAO). (1999b, November). *Foreign military sales: Efforts to improve administration hampered by insufficient information* (GAO/NSIAD-00-37). Retrieved from http://www.fas.org/asmp/resources/govern/gao0037.pdf

Government Accountability Office (GAO). (2009, May). *Foreign military sales program needs better controls for exported items and information for oversight* (GAO-09-454). Retrieved from http://www.gao.gov/new.items/d09454.pdf

Hartung, W. D. (1999). False expectations: Can arms exports make up for cuts in Pentagon procurement? In L. V. Sigal (Ed.), *The changing dynamics of U.S. defense spending* (p. 178). Westport, CT: Praeger.

Inklebarger, T. (2011, February). PBGC premium hikes in federal budget debated. *Pensions & Investments*. Retrieved from http://www.pionline.com/article/20110221/PRINTSUB/302219946

International Society of Parametric Analysts (ISPA). (2008, April). *Parametric estimating handbook* (4th ed.). Retrieved from http://www.ispa-cost.org/ISPA_PEH_4th_ed_Final.pdf

Is the PBGC next? (2008, November). Retrieved from http://www.economist.com/blogs/freeexchange/2008/11/is_the_pbgc_next

Military assistance requirements for FY1990: Hearings before the Subcommittee of Foreign Operations of the House Appropriations Committee, 101st Cong. 35 (1989) (testimony of Charles W. Brown).

Naval Center for Cost Analysis (NCCA). (2011, January). Joint inflation calculator (JIC). Retrieved from http://www.ncca.navy.mil/tools/inflation.cfm

Office of Management and Budget (OMB). (2010a). Historical tables. Retrieved from http://www.whitehouse.gov/omb/budget/Historicals

Office of Management and Budget (OMB). (2010b, July). Object classification (MAX Schedule O). In *Preparation, submission, and execution of the budget* (Circular A-11). Retrieved from http://www.whitehouse.gov/sites/default/files/omb/assets/a11_current_year/a_11_2010.pdf

Office of Personnel Management (OPM). (2008, May). Federal employment statistics. Retrieved from http://www.opm.gov/feddata/html/2008/may/intro.asp

Office of the Secretary of Defense (OSD). (2008, January). Defense agencies. Retrieved from http://odam.defense.gov/omp/pubs/guidebook/Pdf/DefAg.PDF

Office of the Secretary of Defense (OSD). (2010, May). Organizational chart of OSD. Retrieved from http://odam.defense.gov/omp/Library/DoD_Organization_Chart_May_2010_Update.pdf

Pension Benefit Guaranty Corporation (PBGC). (2010, November). *PBGC 2010 annual report*. Retrieved from http://www.pbgc.gov/Documents/2010_annual_report.pdf

Pension Benefit Guaranty Corporation (PBGC). (2011, April). Variable rate premiums. Retrieved from http://www.pbgc.gov/prac/interest/vrp.html

Webster, K. (2005). *Security assistance fees, administrative surcharge and logistics charge: Recommendations for the future*. PowerPoint presentation at the meeting of the Defense Security Cooperation Agency (DSCA), Arlington, VA.

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