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Budgetary and programmatic fluctuations during the system development and demonstration phase: a case study of the Marine Corps H-1 Upgrade Program

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MBA PROFESSIONAL REPORT

Budgetary and Programmatic Fluctuations during the System Development and Demonstration Phase: A Case Study of the Marine Corps H-1 Upgrade Program

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December 2007

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Congress and Department of Defense continue their yearly quest to fund the National Defense Acquisition Strategy with a defense budget that finds itself spread across more military acquisition programs and competing with the redirection of funds supporting supplemental requirements including increased national security and the military presence in Iraq and Afghanistan. Compounding these external funding issues are a multitude of defense acquisition programs that continue to experience internal program cost overruns. Most major defense acquisition programs take well over ten years to reach full-rate production. These programs exceed long-term projected costs because initial developmental and procurement costs are estimated for only short-term accuracy. This case study investigates the fluctuations in the reported budgetary projections and selected acquisition reported costs during the System Development and Demonstration Phase of the Marine Corps H-1 Upgrade Program, while cross-referencing potential programmatic causes for cost overruns. The purpose of this case study is to research a major defense acquisition program, which has experienced a program acquisition unit cost breach, and explore the distribution of the cost increases of the internal and external developmental variables associated with reporting long-term cost of defense acquisition procurements.

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BUDGETARY AND PROGRAMMATIC FLUCTUATIONS DURING THE SYSTEM DEVELOPMENT AND DEMONSTRATION PHASE: A CASE STUDY OF THE MARINE CORPS H-1 UPGRADE PROGRAM

Stephanie M. Polesnak, Captain, United States Marine Corps

Submitted in partial fulfillment of the requirements for the degree of

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BUDGETARY AND PROGRAMMATIC FLUCTUATIONS DURING THE SYSTEM DEVELOPMENT AND DEMONSTRATION PHASE: A CASE STUDY OF THE MARINE CORPS H-1 UPGRADE PROGRAM

ABSTRACT

Congress and Department of Defense continue their yearly quest to fund the National Defense Acquisition Strategy with a defense budget that finds itself spread across more military acquisition programs and competing with the redirection of funds supporting supplemental requirements including increased national security and the military presence in Iraq and Afghanistan. Compounding these external funding issues are a multitude of defense acquisition programs that continue to experience internal program cost overruns. Most major defense acquisition programs take well over ten years to reach full-rate production. These programs exceed long-term projected costs because initial developmental and procurement costs are estimated for only short-term accuracy. This case study investigates the fluctuations in the reported budgetary projections and selected acquisition reported costs during the System Development and Demonstration Phase of the Marine Corps H-1 Upgrade Program, while cross-referencing potential programmatic causes for cost overruns. The purpose of this case study is to research a major defense acquisition program, which has experienced a program acquisition unit cost breach, and explore the distribution of the cost increases of the internal and external developmental variables associated with reporting long-term cost of defense acquisition procurements.

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TABLE OF CONTENTS

LIST OF FIGURES

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LIST OF TABLES

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LIST OF ACRONYMS AND ABBREVIATIONS

ACAT	Acquisition Category
ADM	Acquisition Decision Memorandum
APN	Appropriation
APU	Auxiliary Power Unit
ARA/AM	Acquisition Resources & Analysis/Acquisition Management
BA	Budget Authority
BEA	Business Enterprise Architecture
BY$	Base Year Dollars
CY$	Current Year Dollars
DAB	Defense Acquisition Board
DAES	Defense Acquisition Executive Summary
DAMIR	Defense Acquisition Management Information Retrieval
DECU	Digital Electronic Control Unit
DoD:	Department of Defense
EMD	Engineering and Manufacturing Development
EVM	Earned Value Management
FRPD	Full Rate Production and Deployment
FY	Fiscal Year
FYDP	Fiscal Year Defense Budget
HOGE	Hover Out of Ground Effect
HUD	Heads up Display
IAS	Integrated Avionics System
JCID	Joint Capabilities Integration and Development System
LRIP	Low Rate Initial Production
MDAP:	Major Defense Acquisition Program
NDAA	National Defense Authorization Act
NSC	National Security Council
NVD	Night Vision Digital
OMB	Office of Management and Budget
OPEVAL	Operational Evaluation

PAUC	Program Acquisition Unit Cost
PB	President's Budget
PPBES	Planning Programming Budgeting and Execution System
PUC	Procurement Unit Cost
RDT&E	Research Development Test and Evaluation
SECDEF	Secretary of Defense
SAE	Service Acquisition Executive
SAR	Selected Acquisition Reports
SDD	System Development and Demonstration
TSS	Target Sight System
UCR	Unit Cost Report
USD AT&L	Under Secretary of Defense for Acquisition, Technology and Logistics
USMC	United States Marine Corps

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Professor Jones,

I knew midway through our Defense Budget and Financial Management Policy class that I would only be so fortunate to have you as a lead advisor. Thank you for having the faith and confidence in my ability to fulfill this project under your tutelage.

Diana Petross,

Our educational relationship may have begun as student-professor, but over the course of 18 months your guidance and understanding has meant the world to me. Thank you for seeing me through the rough spots by providing the personal and professional counsel that carried to the completion of this project.

I wish to extend my most sincere gratitude to the following individuals from the H-1 Upgrade Program Office who through their assistance and guidance this paper has been the culminating learning experience. As a student-based MBA Project, all focus was on providing a value-added learning experience towards my graduation and not once did they ask for anything in return.

Colonel Keith Birkholz, USMC	PMA-276
LtCol David Thompson, USMC	Production Integrated Product Team Lead
Maj Walter Murphy, USMC	Assistant Program Manager - Logistics
Maj Gregory D. Anderson, USMC ret.	H-1 Transition Task Force and Wpns Lead
Patrick Saccomandi	PMA-276 Database Administrator
Richard Tilghman	PMA-276 Business Financial Manager
Jennifer R. Leikach	H-1 Lead Cost Analyst
Rolf Hammerer	H-1 Earned Value Management Analyst

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Dedicated to Helen

Though you left this world June 11, 2007...you will forever be in my heart.

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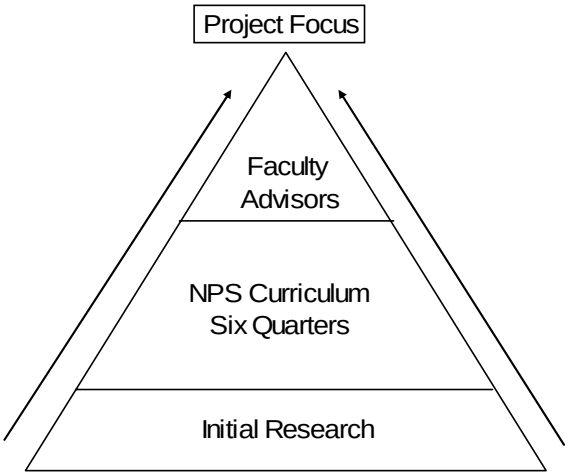
I. INTRODUCTION

A. AREA OF RESEARCH

This MBA Project Report was cultivated out of a desire to integrate an interest in the Marine Corps H-1 helicopter community and the required completion of a student-centered research project. An incremental pyramid approach was applied as this project evolved out of the application of knowledge and skills learned in courses studied over the past 18 months. To understand the pyramid approach, visualize the wealth of knowledge and data associated with any major defense acquisition program in the shape of a pyramid. The initial research, the base of the pyramid, exposes one to all topics and issue of a program. As the academic curriculum progresses, each quarter allows the movement up a level of the pyramid were knowledge and further understanding focuses the student. Through the assistance of Faculty Advisors, the student reaches the top of the pyramid where a viable research topic and the accompanying questions are refined and presented.



All courses provided the educational knowledge to complete this project, three specific courses (1) Principles of Acquisition and Program Management, (2) Defense Budget and Financial Management Policy, and (3) Defense Systems Contracting provided the opportunity to write and expand on a term paper revolving around the H-1 Program. The continuous informational research, collection, and analysis of data provided a learning process documented in this case study. As this project required a

great deal of refinement, what may not be evident from this case study is the amount of knowledge and exposure to additional relevant topics, such as Acquisition Reform, Governmental Policy, and Cost Account Practices, that complemented, shaped and expanded the overall core learning experience of this MBA Project.

B. RESEARCH QUESTIONS

1. Primary Question

How have the H-1 Upgrade Program costs increases changed since the 2001-2002 Nunn-McCurdy Breach?

2. Secondary Questions

a. What are the background and history of the H-1 helicopter and H-1 Upgrade Program?

b. How does recent acquisition reform of the Nunn-McCurdy Thresholds affected the H-1 Upgrade Program?

c. How do the cost variance categories contribute independently and collectively to the overall program cost increases during the EMD/SDD Phase?

d. Has the H-1 Upgrade Program cost increases stabilized?

e. Do program Selected Acquisition Reported Data and the President's Budgeted Data reconcile?

C. SCOPE

In May 2007, contact was made with the Program Manager of the H-1 Upgrade Program and without hesitation; the Program Manager opened the doors of the program. In his exact words,"…to assist in shaping my research efforts into a meaning contribution for the program and quality learning experience for you." Direct Authorization and permission to assist was given immediately to his most senior staff. Over the months,

phone calls, emails and information was exchanged; each person who assisted treated me as though I was part of the team. Never once were my inquires turned away or left unanswered.

Interest in the program gravitated to cost issues associated with major defense acquisition programs. After a lengthy conference call, with the program Cost Analyst, the decision was to focus the analysis on, publicly accessible, Selected Acquisition Reports (SAR) and Comptroller data (President's Budget). Without the assistance and guidance of both the Cost and Earned Value Management (EVM) Analysts, weeks would have been spent learning and reviewing CPR data, only to discover the analysis beyond the available timeline or scope of this paper. Though this case study may not provide the "meaningful contribution" I had hope to give back to the program, it is because of the patience and willingness of all whom I have contacted in the program office that this paper has been the culminating learning experience for me. Please see the acknowledgements for all who assisted in focusing and refining the scope of this case study.

D. CHAPTER OVERVIEW

Chapter II provides an overview of the H-1 helicopter mission need statement, historical background of the H-1's integration into the Marine Corps, the operational requirements and technical characteristics addressed in the upgrade, and briefly discusses the contractual developments and adjustments which occurred during the ten year timeline.

Chapter III reviews the Defense Acquisition System Management Framework, the Defense Acquisition Program Life Cycle Management Framework, the Nunn-McCurdy Amendment of 1982, and those reporting requirements publicly accessible.

Chapter IV reports the Comptroller Data, Selected Acquisition Report Summary Data, reviews the overall analysis and provides comparison of the data from all sources.

Finally, Chapter V offers conclusions to the primary and secondary research questions, closing comments and recommendations offered for further research.

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II. H-1 UPGRADE HISTORY

A. MISSION NEED

"The mission of the AH-1W attack helicopter is to provide rotary wing close air support, anti-armor, armed escort, armed/visual reconnaissance and fire support coordination capabilities under day/night and adverse weather conditions. The mission of the UH-1N utility helicopter is to provide command and control and combat assault support under day/night and adverse weather conditions and special operations support; supporting arms coordination and aeromedical evacuation."[1] A prime contract and sole source to Bell Helicopter Textron Inc, the United States Marine Corps (USMC) H-1 Upgrade Program is a Acquisition Category (ACAT) 1D program encompassing the Engineering and Manufacturing Development of new end-items prior to a production approval decision.[2]

B. HISTORY

The H-1 program traces back to the late 1950s supporting the US Army's air-mobility concept in Vietnam. Originally named "Iroquois" and designated the HU-1 (for **H**elicopter, **U**tility), the term Huey comes from this earlier designation.[3] In 1962, under the new tri-service designation system the HU-1 became the H-1. The utility helicopter entered service in 1956 and developed by Bell Helicopter for the US Army. The Army's Aviation Section of the Surgeon General's Office set forth the chief design specification for the utility H-1. This design carried at least four litter cases for the evacuation of wounded troops.[4] A few additional requirements were… troop transport, equipment and

1 Department of the Navy, "FY 2007 President's Budget," Research, Development, Test & Evaluation Budget Navy Budget Activity 5, Line Item 93, p.1.

2 Department of the Navy, "FY 2004 President's Budget," Research, Development, Test & Evaluation Budget Navy Budget Activity 5, Line Item 98, p. 6.

3 H-1 Upgrade Program Website, "History," http://pma276public.navair.navy.mil/pma276public/history .asp (accessed March 2007).

4 Ibid.

supplies, construction and design to permit field maintenance and be transportable via cargo airplane."[5] The first H-1 gunship was an armed Huey (UH-1B series) outfitted by the Army with the M-60 machine gun in the door launching the H-1 into combat operations escort.

As early as 1962, the UH-1E was to become the next generation assault support helicopter for the Marine Corps. Bell constructed the UH-1E. "The Marines also operated armed Hueys in Vietnam, and ordered their own version of the Cobra in May 1968. Featuring the Pratt and Whitney Twinpac T400 engine (two 900-hp turbo shaft engines coupled together) giving an overall increase in installed power, the AH-1J Sea Cobra included a new nose turret gun, the three barrel XM-197 20mm and other improvements. While development and production of the first 49 ordered were under way, the Marines obtained 38 AH-1Gs from the Army. After initial training of Marines by the Army, Marine Huey Cobras first became operational in April 1969 with VMO-2 in Vietnam. In December 1969, the AH-1Gs transferred to HML-367. After flight tests beginning that same month and subsequent BIS trials, the first AH-1Js joined them in February 1971, entering combat the following month. AH-1Js, including those of HMA-369, participated in SE Asia operations until final withdrawal and continued as the Marine's attack helicopter afterwards, a total of 67 being delivered."[6] The last UH-1N came off the assembly line in 1979, while Bell tuned out the last AH-1W in 1998.[7]

C. OPERATIONAL REQUIREMENTS

All operational, maintenance or reliability areas of these aircraft improved dramatically. The following is a list of specific improvements when comparing remanufactured models of both H-1s under the H-1 Upgrade Program:

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5 H-1 Upgrade Program Website, "History," http://pma276public.navair.navy.mil/pma276public/history .asp (accessed March 2007).

6 Fox Company Vietnam 1963 to 1969 Website, http://www.foxco-2ndbn-9thmarines.com/choppers.htm (accessed March 2007).

7 Frank Wolfe, "Bell AH-1Z On Schedule For First Flight In October 2000," *Defense Daily*, Aug 9, 1999, Volume 203, Issue 27, p. 1.

Table 1. Cobra Improvement Comparison

Cobra Comparison [8]	AH-1W	AH-1Z	Improvement [percent]
Max Gross Weight	14,750 lbs	18,500 lbs	25
Max. Internal Fuel	2,100 lbs	2,768 lbs	32
Maximum speed	190 kts	222 kts	17
Cruise speed	131 kts	142 kts	8
Service ceiling	14,700 feet	20,000 feet	36
Mission Radius	58 nm	128 nm	121

Table 2. Huey Improvement Comparison

Huey Comparison [8]	UH-1N	UH-1Y	Improvement [percent]
Max Gross Weight	10,500 lbs	18,500 lbs	76
Max. Internal Fuel	1,360 lbs	2,584 lbs	90
Maximum speed	130 kts	198 kts	52
Cruise speed	107 kts	153 kts	43
HOGE Useful Load	3,532 lbs	5,930 lbs	68
Service ceiling	17,300 feet	20,000 feet	16
Mission Radius	N/A	125 nm	N/A

Two main operational requirements of the upgrade program were to provide significant enhancement of the combat effectiveness and survivability of each type/model aircraft. "Effectiveness will be improved with the new cockpit and integrated avionics systems, increased weapons quantities and accuracy, and improved speed, range, and payload capabilities (see comparison charts above). Survivability is enhanced through

8 H-1 Upgrade Program Website (2007), http://pma276public.navair.navy.mil/pma276public/program.asp#_Toc81179683.

ballistic hardening, redundant systems, damage tolerant materials and design, extensive explosion/fire protection, signature reduction, and improved electronic countermeasures."[9]

D. TECHNICAL CHARACTERISTICS

Major modifications for both aircraft that remanufacture AH-1W/UH-1N's into AH-1Z/UH-1Y's include: a new 4-bladed, composite rotor system with semi-automatic blade fold, new performance matched transmissions, T700 Engine Digital Electronic Control Units (DECUs), new 4-bladed tail rotors and drive systems, more effective stabilizers, upgraded landing gear, tail pylon structural modifications, and common, fully integrated cockpits and avionics systems.

> This remanufacture will add 10,000 flight hours to AH-1Z/UH-1Y airframes. The fully integrated cockpits will reduce operator workload and improve situational awareness, thus increasing safety and reducing the rate of aircraft attrition. They will provide considerable growth potential for future weapon systems and avionics, which will significantly increase mission effectiveness and survivability. The cockpits will also include integration of onboard mission planning, communications, digital fire control, self-navigation, night navigation/target in and weapon systems management in nearly identical crew stations, which significantly reduces training requirements. This remanufacture maximizes commonality between the two aircraft and provides needed improvements in crew and passenger survivability, payload, power available, endurance, range, airspeed, maneuverability and supportability.[10]

Having 84 percent AH-1Z/ UH-1Y identicality in maintenance-related components provides these operational and fiscal benefits (1) makes shipboard deployment easier and less spares to store on board (2) smaller strategic lift footprint, (3) increased readiness Lower Life Cycle Costs.[11] Below is a list of all the common components

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9 H-1 Upgrade Program Website (2007), http://pma276public.navair.navy.mil/ pma276public/program.asp.

10 Department of the Navy, "FY 2007 President's Budget," Research, Development, Test & Evaluation Budget Navy Budget Activity 5, Line Item 93, p. 1.

11 H-1 Upgrade Program Website (2007), http://pma276public.navair.navy.mil/pma276public /program.asp.

Table 3. Common Components [12]

Common Components	
T700-GE-401 engine	Main rotor system
Main rotor folding provisions	Tail rotor system
Flight control actuators	Complete drive system
Gearbox oil cooling	Auxiliary power unit
Engine exhaust IR suppressors	Tailboom
Hydraulic components	Selected electrical components
Integrated avionics system (IAS) components	Engine and APU compartment fire detection and suppression

One of the most interesting additions to both H-1 systems is a two-piece helmet called the Top Owl intended to help reduce pilot workload in the cockpit for tracking, aiming, and cueing weapons and other onboard systems. The Top Owl currently used in the attack helicopters in Europe and South Africa, featuring fourth generation Night Vision Digital (NVD) technology, visor displaying of night vision imaging and Heads Up Display (HUD) data.[13]

E. CONTRACTUAL ADJUSTMENTS

In 1996, Bell Helicopter Textron Inc. and the US Navy were in the mists of completing negotiations for an Engineering, Manufacturing and Development (EMD) contract for the upgrade of 280 H-1 helicopters of the Marine Corps inventory.[14] Under a one-year study contract, Bell would define the upgrade program that would address the four-blade rotor system, engines, drive trains, hydraulic systems, avionics and cockpit features.[15] By 1998, Bell had completed 40 percent of the design phase having chosen

12 H-1 Upgrade Program Website (2007), http://pma276public.navair.navy.mil/pma276public /history.asp.

13 Ibid., program.asp,

14 William B. Scott, "Bell to Upgrade Marine Corps Super Cobra, Twin Hueys," *Aviation Week & Space Technology*, August 19, 1996. Volume 145, Issue 8, p. 72.

15 Ibid.

General Electric to manufacture the engines (and transmissions) and Lucas Aerospace to supply the driveshaft.[16] The plan called for the modifications of three AH-1W's and two UH-1N's for flight testing and evaluation by Marine Corps pilots.[17] Lockheed Martin was awarded the contract from Bell to build the Target Sight System during the summer of 1998.[18]

Of the five flight test aircraft built and delivered to the integrated test team in Patuxent River, AH-1Z #1 is used for envelope expansion, handling qualities, and structural flight demonstrations while upon completion of EMD testing will be used as a Live Fire Test and Evaluation aircraft.[19] The four aircraft remaining, two UH-1Ys and two AH-1Zs, will be flown in support of the test program through Operational Evaluation (OPEVAL) and will be converted to maintenance trainers upon completion of testing.[20]

In mid-October 2003, the Defense Acquisition Board authorized the first Low Rate Initial Production (LRIP) phase to remanufacture six UH-1Ns and three AH-1Ws at a cost of about $202 million surpassing a huge milestone transitioning the H-1 Upgrade Program from the developmental phase to production phase.[21]

> On 15 April 2005, the undersecretary of defense for acquisition, technology and logistics, signed the Acquisition Decision Memorandum (ADM) that would provide 'new-built' UH-1Y's to the Marine Corps fleet starting in 2008 as part of the third lot LRIP aircraft. Due to the increase operational tempo coupled with the average age and attrition rate, as well as the marginal cost difference between new-build and remanufacturing, it

16 Edward H. Phillips, "Marine Corps H-1 Upgrade on Track," *Aviation Week & Space Technology*, New York: May 4, 1998. Volume 148, Issue 18, p. 47.

17 Ibid.

18 Frank Wolfe, "Joint Staff Endorses New Targeting System For AH-1Z," *Defense Daily*, Nov 12, 1998. Vol. 200, Issue 58, p. 1.

19 H-1 Upgrade Program Website (2007), http://pma276public.navair.navy.mil/pma276public /program.asp.

20 Ibid.

21 *Defense Daily*, "DAB Gives H-1 Upgrade Program For Marine Corps Green Light To Begin LRIP," Oct 27, 2003. Volume 219, Issue 18, p. 1.

had been concluded that building the UH-1Y from the ground up better supported the needs of the Marine Corps.[22]

In July of 2005, Bell Helicopter Textron received the Naval Air Systems Command $104.2 million price/contract modification to the previously firm-fixed price contract that was awarded to fund the LRIP Lot II H-1 upgrade procurement.[23]

In April 2006, a contracting officer at Naval Air System Command, wrote to Bell Helicopter Textron Inc., disturbed that two independent reviews had concluded there were multiple areas of concern, one being whether Bell could perform to the contract and deliver the H-1 on schedule and whether the program could go forward in accordance with the Bell Price Commitment letter of January 2006.[24] The Defense Acquisition Board (DAB) review of the H-1 Upgrade Program determined that the overall performance of Bell-Textron had improved. The Navy scheduled another DAB in October 2006 to review both Bell's and the program's performance. At this review, Bell would present a recommendation to meet the Marine Corps' Light/Attack helicopter requirements and present a risk management plan to Department of Defense (DoD).[25] In the third week of July 2006, the H-1 Upgrade Program surpassed another significant milestone; the Navy signed a $137 million contract for the first seven Lot 3 Bell Helicopter Textron UH-1Y helicopters as well as a full flight simulator and maintenance/training.[26]

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22 Navy Newsstand: NAVAIR Bulletin Board , "UH-1Ys to be built new starting in 06," Story Number: navair050422-02, April 22, 2005, downloaded http://www.navy.mil/search/print_bbs.asp?bbs_id=1332.

23 *UNITED STATES Overhaul & Maintenance*. Washington: Jul 1, 2005. Vol. 11, Issue. 6, p. 94.

24 *Defense Daily*, "H-1 Upgrade Program To Press Forward, But Navy Could Consider Alternatives," Potomac: Jun 27, 2006. Vol. 230, Issue 61, p. 1.

25 *Defense Daily*, "Navy to Award LRIP III for H-1 Upgrade, Will Keep Close Watch of Bell's Efforts," Potomac: Jun 28, 2006. Volume 230, Issue 61, p. 1.

26 *Defense Daily*, "Navy Awards Bell $137 Million Contract For First Seven UH-1Y Helicopters," Potomac: Jul 25, 2006. Volume 231, Issue 14, p. 1.

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III. MAJOR DEFENSE ACQUISITION PROGRAMS RESEARCH

A systematic, pyramid approach applied to the research methodology helped to grasp the complex nature of major defense acquisition programs. The following four topics provided an incremental understanding of defense acquisitions. They represent the external and internal variables that influence the defense acquisition process and the determination of cost overruns. The first topic, the Defense Acquisition System Management Framework, provided the basic foundational knowledge. Second, the Defense Acquisition Program Life-Cycle Management Framework converge of the research on the System Development Demonstration Phase. Third, the Nunn-McCurdy Amendment of 1982 defines the purpose, categories, and thresholds of cost overruns. Finally, the reporting requirements supplied the hard data to facilitate answering the primary and secondary research questions.

A. DEFENSE ACQUISITION "SYSTEM" MANAGEMENT FRAMEWORK

In constructing a solid knowledge base, initial research began by dealing with the process or system as a whole. The DoD Directive 5000.1 provides the following overview as a basic understanding of the DoD acquisition system policy.[27]

> The Defense Acquisition System exists to manage the nation's investments in technologies, programs, and product support necessary to achieve the National Security Strategy and support the United States Armed Forces. The investment strategy of the DoD shall be postured to support not only today's force, but also the next force, and future forces beyond that. The primary objective of defense acquisition is to acquire quality products that satisfy user needs with measurable improvements to mission capability and operational support, in a timely manner, and at a fair and reasonable price.

One of the more popular teaching tools is to apply the "Systems Framework" to the defense acquisition process. Many journals or books utilize similar teaching aids for explaining the system framework, this research focused on a version taught by Professor

[27] Department of Defense Directive 5000.1, "The Defense Acquisition System," May 12, 2003, Office of the Under Secretary of Defense for Acquisition, Technology and Logistics, Chapter 4, p. 2.

Rene Rendon, instructor for "Systems Defense and Contracting Course" at the Naval Postgraduate School. The basic framework builds around an adaptation of Schoderbek's System Framework illustrated in Figure 1. The flexibility of this framework breaks down the acquisition process into the external and internal variables that affect the process throughout the five themes: environment, inputs, conversion, outputs and feedback.

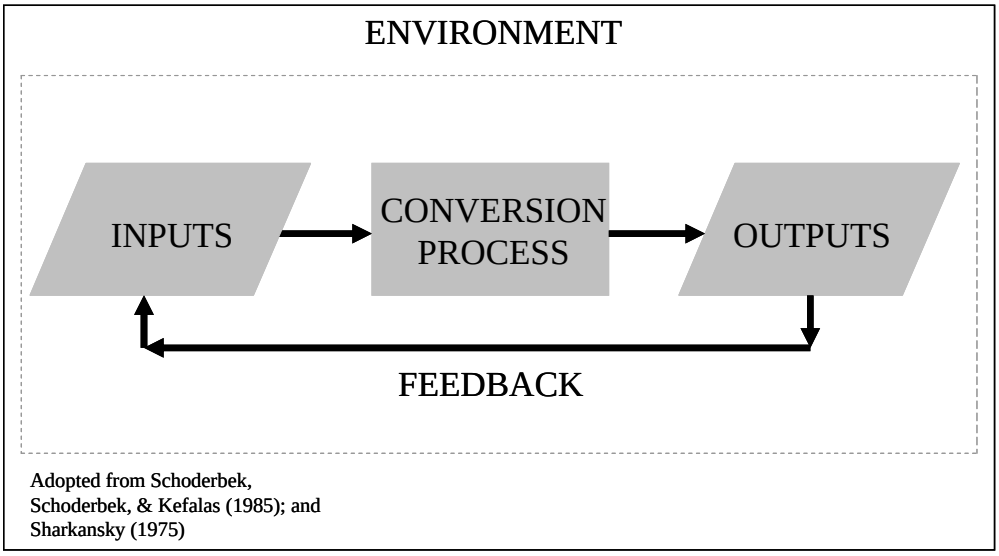

Figure 1. The System Framework

1. Environment

The "environment" that surrounds the defense acquisition process is one of the largest and most complicated external influences. Table 4 lists some of the most influential entities within the system framework environment. The executive branch includes the President, the Office of Management and Budget (OMB), the National Security Council (NSC), and the Department of Defense.[28] The President looks to defense acquisition as an instrument to assist in the formulation, direction, and execution of his national security policy in an effort to maintain a balanced force structure.[29] Since the 9/11 tragedy, Defense leaders have coordinated and managed acquisitions during a

28 Defense Acquisition University, "Introduction to Defense Acquisition Management – 6th Edition," Defense Acquisition University Press, Fort Belvoir, VA: 25 Nov 2003, p 3.

29 Ibid.

time of political unrest and multiple offensive war fronts. DoD's responsibilities rest in selecting and supporting those major defense acquisition programs that satisfy national security objectives and field weapons systems to defeat threats to national defense.[30] DoD struggles with providing the warfighter with the tools and resources to accomplish a mission, while attempting to satisfy regulatory and legislative requirements in cost, schedule, and performance. OMB oversees the preparation of the federal budget and supervises the administration of procurements, financial management, information, and regulatory policies to reduce any unnecessary burdens on the public.[31] Public perception has an untended manipulative effect on military acquisition programs.

Table 4. Environment – Defense Acquisition System Framework

"Environment" Defense Acquisition System Framework
Executive Branch
Legislative Branch
Judicial Branch
Defense Industry
Political Interest Groups
Taxpayers
Public Perception

As both Congress and the President "serve at the will of the people," it is not surprising that the public's interpretation on the success or failure of a defense program weighs heavily on the level of Congressional and Executive support for that program. The American taxpayer wants the most capable military in the world, yet, they have begun to voice dissatisfaction to over 30 years of cost and schedule overruns. Public perception of the defense acquisition system as "broke and out of control" is a legitimate concern and permeates through the political reelection process. The Defense Industry and Special Interest Groups utilize the political reelection process to influence the defense acquisition arena. As these two entities provide political funding for both

30 Defense Acquisition University, "Introduction to Defense Acquisition Management – 6th Edition," Defense Acquisition University Press, Fort Belvoir, VA: 25 November 2003, p 3.

31 Office of Management and Budget, "OMB's Mission," website: http://www.whitehouse.gov/omb/organization/role.htm (accessed 10 October 2007).

Congressional and Executive candidates, they mold or indirectly influence the defense acquisition process with the intent on bringing more dollars and jobs to specific states or jurisdictions.

2. Input

The "inputs" to the defense acquisition system framework revolve around the needs and desires to support the National Security Strategy, the available resources, and the obligatory Congressional checks and balances. The President's political agenda and policy determine employment of the nation's military forces. On top of the political agenda, geographic location, the enemy combat capabilities or threats, and world opinion all play a vital part in influence military missions.

Resources dictate the utilization of specific inputs in the acquisition process to meet military missions. Resources divide into tangible and intangible categories. Tangible resource fall into manpower, material, and appropriated funding issues; where as intangible resources are personnel skill levels, maturity of technology, and inflationary values.

Table 5. Input – Defense Acquisition System Framework

"Input" Defense Acquisition System Framework
Warfighter needs and desires
Resources
Regulations, Directives, Instructions
Legislative Actions and Statutes
Socio-economic needs and desires

As DoD juggles the available resources, the needs and desires of both the warfighter and socio-economic characteristics are simultaneously funneled into the defense acquisition system framework. Socio-economics studies the relationship between economic activity and social life where the social impact of economic change might include a closing factory, market manipulation, the signing of international trade

treaties, or the global availability of crude oil in Iraq.[32] Rounding out the inputs is the nation's system of checks and balances. On a positive note, regulations, directives, and legislative actions, in a democratic society, help to institutionalize better business practices, while providing enough breathing room for the necessary interpretation. On the downside, regulations and legislative actions are a continuous cycle and learning process. Congressional responsibility requires its members to asked questions and demand explanations for how funding has been allocated. It is important for the defense community to understand that bureaucratic red tape is a necessary by-product of democracy and a long-standing input to the defense acquisition process.

3. Conversion

As the Congressional body sets forth the policy, the "how to" is located within the conversion framework. Beginning with the Joint Capabilities Integration and Development System (JCIDS) were the Chairmen of the Joint Chiefs of Staff identify and document the methodology of how the military services will determine warfighting needs through mission deficiencies or technological opportunities.[33] The Planning Programming Budgeting and Execution (PPBE) System is utilized by DoD services and prescribes the process in making decisions on funding which provide the operational commanders-in-chief the best mix of forces, equipment, and support attainable with the fiscal constraints established by Congress.[34]

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[32] Wikipedia, "Definition of Socioeconomics," http://en.wikipedia.org (accessed October 10, 2007).

[33] Defense Acquisition University, "Introduction to Defense Acquisition Management – 6th Edition," Defense Acquisition University Press, Fort Belvoir, VA: 25 November 2003, p 23.

[34] Department of Defense Directive 7045.14, "The Planning, Programming, and Budgeting System," Certified Current as of November 21, 2003, p 2.

Table 6. Conversion – Defense Acquisition System Framework

"Conversion" Defense Acquisition System Framework
Requirements Determination (JCIDS)
Resource Allocation (PPBE)
Acquisition (DoD 5000)
Procurement (FAR and Supplements)
Systems Engineering
Service Structures

The conversion process is the most time consuming of all five elements. Changes in policy and lessons learned, within the defense acquisition process, require the continuous updating of DoD directives. The extensive number of directives and volume of publications, see Table 6, of the conversion process becomes one of familiarity vice memorization.

4. Output

The "output" or final product of any defense acquisition program typically is the successful fielding of the system or service. What must not be overlook is the the program office reflecting on whether the system provides the nation the security or defense capabilities that originally was intended. How has the socio-economic elements been influenced by the program completion? Does the acquisition provide the operational priorities intended by the military? The original "environmental" influences continue to affect a program's operational and support requirements well after system fielding.

Table 7. Output – Defense Acquisition System Framework

"Output" Defense Acquisition System Framework
Weapons System
Services
Socio-economic Benefits
National Security
National Defense

5. Feedback

As with any task, the "feedback" provides the defense acquisition system framework with the opportunity to learn from mistakes and tweak the process. Feedback is real-time or post-process. With the average life cycle of defense acquisition programs at 10 to 20 years, real-time feedback appears in the form of Government Accountability Office Reports, Inspector General Reports, and Defense program reports on cost, schedule, and performance. Acquisition Reforms and Business Transformational Initiatives are both by-products of critical analysis of the defense acquisition process. Feedback shapes and influences the environmental and input elements of the system.

Table 8. Feedback – Defense Acquisition System Framework

"Feedback" Defense Acquisition System Framework
Effects/Influences Environment & Inputs
Transformational Initiatives
Acquisition Reform Initiatives
Government Accountability Office Reports
Inspector General Reports

B. EVOLUTION OF DEFENSE ACQUISITION PROGRAM "LIFE CYCLE" MANAGEMENT FRAMEWORK

The evolution of the Defense Acquisition Program Management Framework has spanned twenty years from 1987 to 2007. In 1989, Defense Systems Management College published the first edition of the "Introduction to Defense Acquisition Management." The guide or pamphlet, focusing on the DoD-wide applications, is published as a quick study to refresh the skilled and experienced person or introduce and enlighten the newcomer.[35] Over the years, the varying editions of the pamphlet have focused on the changes in military guidance, Congressional direction, feedback, and

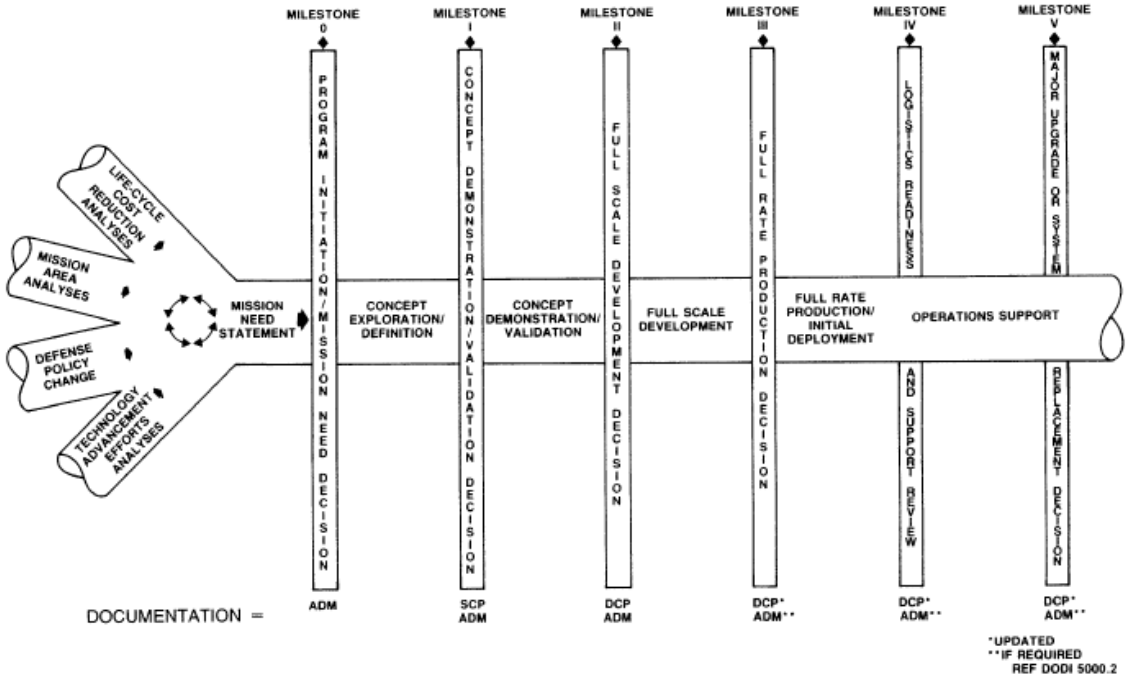
[35] Defense Systems Management College, "Introduction to Defense Acquisition Management," Virginia: Fort Belvoir, p. V.

reformation. The life cycle framework is constructed around a simplistic design structure and activities: mission need, concept exploration, concept or technological development, system development, system demonstration, production, deployment, operations, support, and disposal. The life cycle is broken down into time-base phases. Each phase corresponding to the specific structure or activities within the life cycle process, as mentioned above.

Concept exploration evaluates the feasibility of alternative concepts for meeting the mission need, determining the most promising concepts or solutions and then which concepts to be pursued. Concept development focuses on the subsystems and components in a relevant environment prior to integration into a system. Phase O has evolved into what is know as "Pre-Systems Acquisitions" including identification of mission needs to passing Milestone B entrance criteria. Phase I, System Integration concentrates on integrating the subsystems and components and then testing them in a relevant environment. Depending on the year, a MDAP began, this is known as the Engineering & Manufacturing Development (EMD) Phase or System Development & Demonstration (SDD) Phase. Phase II, Production and Deployment is made up of areas: Low-Rate Initial Production (LRIP) and Full-Rate Production & Deployment (FRPD).

Exiting LRIP is typically permitted only when the program illustrates technical maturity, no significant manufacturing risk, acceptable interoperability of subsystems and components, and operational supportability is shown to be at acceptable levels for the increased production.

Figure 2. Defense Acquisition Life Cycle Management Framework 1989 to 1993[36]

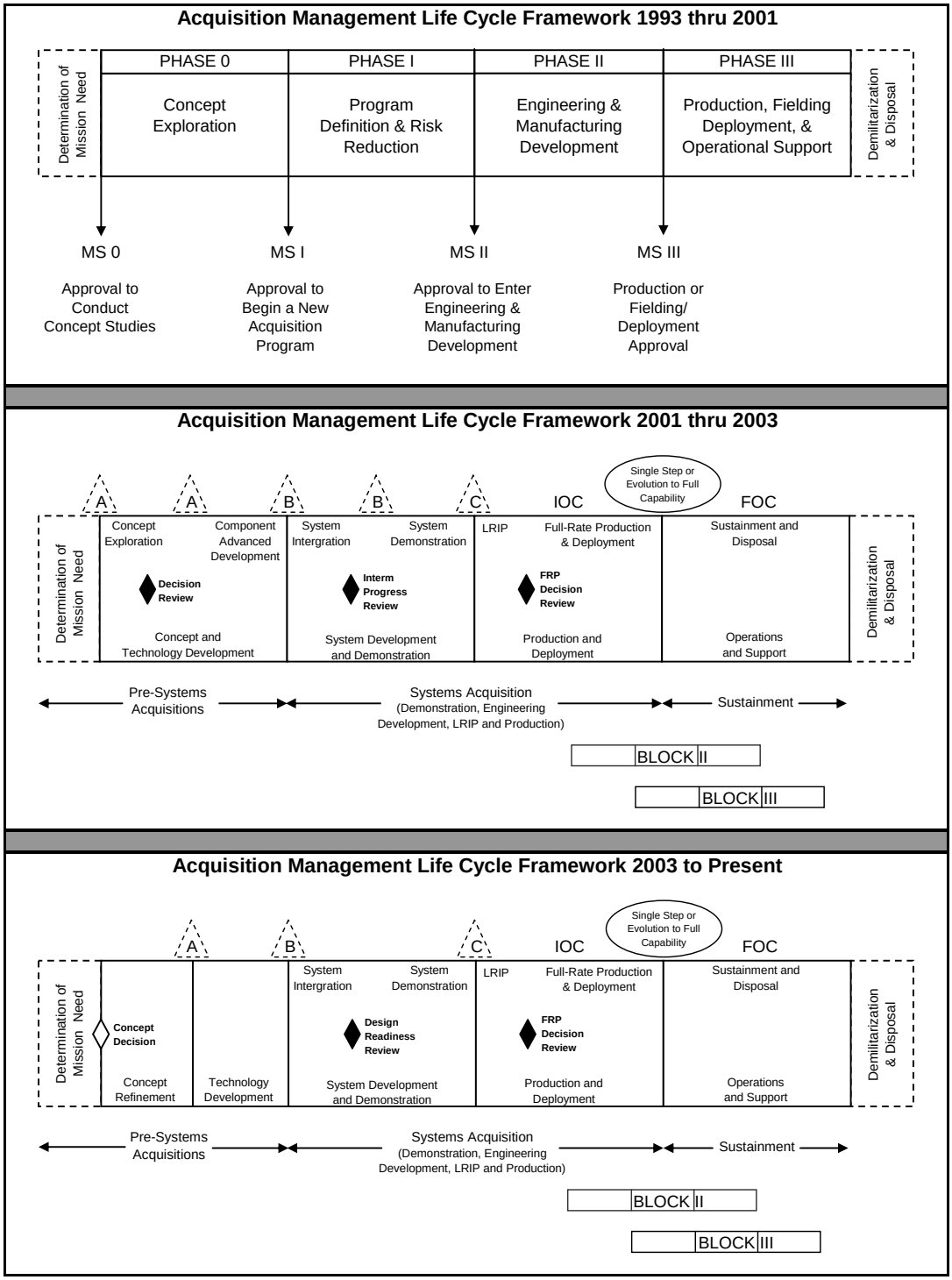


Phases I and II are referred to as the "Systems Acquisitions" of a MDAP. Finally, management framework "Sustainment" is the operational and support a program would require throughout it lifetime. A programs eventual disposal, demilitarization, detoxification, waste storage and/or recycling at the end of its economic or physical service life would also fall under "Sustainment."

Decision points, referred to as milestones, separate phases and transitioning from one phase to another requires program officials attaining upper level approval. "Tailoring" of the process has allowed for adjustments to the life cycle process in order to respond to the unique programmatic circumstances of individual MDAPs. Figures 2 and 3 allow comparison of the life cycle frameworks developed and illustrate the evolutionary changes from 1989 to the present.

[36] Defense Systems Management College, "Introduction to Defense Acquisition Management," Virginia: Fort Belvoir, p. 15.

Figure 3. Evolution of Acquisition Management Life Cycle Framework 1993 to Present



C. NUNN-MCCURDY AMENDMENT OF 1982

1. Background

In 1982, Senator Sam Nunn, a Democrat from Georgia (D-GA), with the help of Representative Dave McCurdy, Democrat from Oklahoma (D-OK), drafted a Conference Report that was included in the fiscal years Department of Defense (DoD) Authorization Act. Known today as the Nunn-McCurdy Amendment, the objective of the legislation was to establish an exception reporting system on Major Defense Acquisition Program (MDAP) unit costs, in order to, track development as well as procurement cost growth and contract cost growth as a precursor of program costs.[37]

The 1982 original language may be found coupled to the Selected Acquisition Report, March 1981.[38] The original provisions required Program Managers to notify the Service Acquisition Executive (SAE) when unit cost growth on MDAPs reached at least 15 percent in Program Acquisition Unit Costs (PAUC). The SAE would give notice to Congress of the programs breached unit cost thresholds. Furthermore, Secretary of Defense (SECDEF) Certification was mandatory if cost growth surpassed 25 percent PAUC requiring a written and/or testimonial justification. SECDEF Certification entails the Under Secretary of Defense for Acquisition, Technology and Logistics (USD AT&L) to address the following four statutory requirements.[39]

- Program is essential to national security;
- No alternatives to such acquisition program which will provide or greater military capability at less cost;
- New estimates of the program acquisition unit cost or procurement unit cost are reasonable; and,

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[37] Larry Axtell, "Nunn-McCurdy Changes Presentation," 2006 Business Managers' Conference: Enabling Smart Business Decisions, 9-10 May Defense Acquisition University, Ft. Belvoir, VA. http://www.dau.mil/conferences/2006/documents/Session%202.pdf.

[38] Department of Defense Authorization Act 1982, Conference Report No. 97-311. Downloaded http://www.cdi.org/missile-defense/s815-conf-rpt.cfm.

[39] Defense Link (2002), "Nunn-McCurdy Unit Cost Breaches," published May 2002, http://www.defenslink.mil/news/may2002/d20020502nme.pdf (accessed September 2007).

- Management structure for acquisition program is adequate to manage and control program acquisition unit cost or procurement unit costs.

In the 1990's, Senator Nunn's reporting system consolidated with the existing internal Defense Acquisition Executive Summary (DAES) and external reports Selected Acquisition Reports Summary (SARs).[40]

A DoD major defense acquisition program is not a highly sensitive classified program designated by the SECDEF or that is estimated by the SECDEF to require an eventual total expenditure for Research Development Test and Evaluation (RDT&E) of more than $300 million (Base on Fiscal Year 1990 constant dollars) or an eventual total expenditure for procurement of more than $1,800 million (BY 1990)."[41] The following are expenditures calculated for a 2000 Base Year for determining an MDAP[42]:

- RDT&E Costs >= $365 million (BY00$) or
- Procurement Costs >= $2.19 billion (BY00$).

The following is the specific location in United States Code Title 10 which discusses the objectives and reporting requirements:

Title 10	Armed Forces
Subtitle A	General Military Law
Part IV	Service, Supply, and Procurement
Chapter 144	Major Defense Acquisition Programs
Sections	2430 Major defense acquisition program defined
	2431 Weapons development and procurement schedules
	2432 Selected Acquisition Reports (SAR)
	2433 Unit cost report
	2435 Baseline description

40 Larry Axtell, "Nunn-McCurdy Changes Presentation," 2006 Business Managers' Conference: Enabling Smart Business Decisions, 9-10 May Defense Acquisition University, Ft. Belvoir, VA. Downloaded http://www.dau.mil/conferences/2006/documents/Session%202.pdf.

41 United States Code Title 10, Subtitle A, Part IV, Chapter 144, Section 2430 Major Defense Acquisition Programs Defined, paragraph (a) (2). Download http://www.access.gpo.gov/uscode/title10/subtitlea_partiv_chapter144_.html.

42 Larry Axtell, "Nunn-McCurdy Changes Presentation," 2006 Business Managers' Conference: Enabling Smart Business Decisions, 9-10 May Defense Acquisition University, Ft. Belvoir, VA. Downloaded http://www.dau.mil/conferences/2006/documents/Session%202.pdf.

MDAP managers are required to submit a quarterly Unit Cost Report (UCR), to their service executive designate, a written report addressing the *program acquisition unit costs* (PAUC)-- meaning the amount equal to[43]:

- The total cost for development and procurement of, and system-specific military construction for , the acquisition program **divided by**
- The number of fully configured end items to be procured within 30 calendar days after the end of each quarter.

The UCR summaries acquisition unit costs or procurement unit costs, cost or schedule variances since contract commencement, program schedule milestone or performance changes, and significant software cost, performance or schedule changes.[44] UCR begins at Milestone B (System Development and Demonstration) and UCR ends at 90% complete of either deliveries or expenditures[45].

2. Nunn-McCurdy Threshold Modifications

In 2006, the National Defense Authorization Act (NDAA) enacted major reform of the acquisition process, specifically the Nunn-McCurdy Cost Thresholds.

> The House of Representative of the Committee on Armed Services release their report (HR 109-452) on the National Defense Authorization Act for Fiscal Year 2007, listed in Title VIII—Acquisition Policy, Acquisition Management and related matters; one of four "Items of Special Interest" was the Major Defense Acquisition Program (MDAP) Reform in which the committee directed the Under Secretary of Defense for Acquisition, Technology and Logistics … to submit a consolidated report describing efforts taken to implement major defense acquisition reform, as implemented by sections 801 and 802 of the NDAA FY 2006 and delivering to the SCAS and HS by March 01, 2007. HASC reported they believed the DoD acquisition process was broken and could be supported by the rising cost/budget and lengthening schedules leading to fewer numbers of each platforms. [46]

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43 United States Code Title 10, Subtitle A, Part IV, Chapter 144, Section 2432(a)(1). Download http://www.access.gpo.gov/uscode/title10/ subtitlea_partiv_chapter144_.html.

44 Ibid., Section 2433(b) (1)-(4).

45 Ibid., Section 2432(g).

46 Congressional Report: H.Rpt. 109-452 – Report of the Committee on Armed Services House of Representatives, "National Defense Authorization Act for Fiscal Year 2007 Report to Accompany H.R. 5122," May 5, 2006, p 352 download at http://www.gpoaccess.gov/serialset/creports/ndaafy07.html.

Sections 801 and 802, of the FY2006 NDAA address this reform. Section 801 required the certification of numerous requirements related to technological maturity, affordability, alternative acquisition strategies and compliance with relevant DoD policies, regulations and directives, prior to approval of Milestone B for a MDAP.[47] While Section 802 rewrote the Nunn-McCurdy amendment stopped the re-baselining of original baseline estimates for MDAPs and redefined the thresholds into two categories[48], presented in Table 9.

Table 9. Reformed Nunn-McCurdy Categories and Thresholds

CATEGORY	THRESHOLDS
"Significant cost growth threshold"	≥ 15% over the PAUC for the program as shown in the current Baseline Estimates for the program, or
	≥ 30% over the PAUC for the program as shown in the original Baseline Estimate for the program
"Critical cost growth threshold"	≥ 25% over the PAUC for the program as shown in the current Baseline Estimates for the program, or
	≥ 50% over the PAUC for the program as shown in the original Baseline Estimate for the program

A baseline estimate is generated taking into consideration sufficient parameters to describe the cost estimate, schedule, performance, supportability, and any other major factors and prepared for any MDAP before the program enters [49]:

- System Development and Demonstration;
- Production and Deployment; and
- Full Rate Production

47 National Defense Authorization Act for Fiscal Year 2006, Public Law 109-168, January 6, 2006, pp. 232-234.

48 Ibid.

49 United States Code Title 10, Subtitle A, Part IV, Chapter 144, Section 2435 (a) (2) & (c).

D. PUBLICLY ACCESSIBLE REPORTING REQUIREMENTS

A major problem encountered in researching the data requirements for this project was simply locating program cost and funding data. As a student based research project, one of the intended products of this MBA Project is the exposure to indebt research methods and data compilation skills. The task took well over three academic quarters to locate and filter cost data on the H-1 Upgrade Program; the journey provided additional exposure to a plethora of military and government journals, websites, and reports. The publicly accessible data utilized in this report came from the following two web-based sites:

- The Office of the Under Secretary of Defense – Comptroller, and
- The Office of the Under Secretary of Defense – Acquisition Technology & Logistics

The following two sections walk the reader through the process of locating naval service program data assuming that at the outset the reader has only the program name.

1. Defense MDAP Budgetary Data

The Office of the Under Secretary of Defense – Comptroller website is located at http://www.defenselink.mil/comptroller/ . After opening the Comptroller website, open the 'Defense Budget' tab on the left hand-side of the screen. Next, follow the 'DoD Summary Budget Materials/Budget Links' tab. Look for the individual YEAR tabs under the HOME tab; notice that 10 years of budgetary data is provide and will be in digital format for downloading. Select the specific year desired prior to moving on to the next step. Under 'Summary Justification Materials' the following list of Budget Appropriation Authorities are presented.

- Military Personnel Program (M-1)
- Operation and Maintenance Program (O-1)
- Procurement Program (P-1)
- Procurement Program Reserve Component (P-1R)
- Research, Development, Test & Evaluation Program (R-1)
- Military Construction, Family Housing, and Base Realignment and Closure Program (C-1)

Any defense program will fall under one or more of these authorities. The final tab under the 'Summary Justification Material' offers the file "Program Acquisition Costs by Weapon System." This is a document prepared for by the DoD for the public or press and provides a short summary on all programs. Though the document is convenient and provides basic information, it does not provide the information required to aid in locating the actual data of a program.

The six budget authority program files typically list the DoD component summaries by Army, Navy, Air Force, and Defense Agencies. Utilize these summaries to locate specific program Line Numbers, Program Element Numbers, Item Nomenclature, and Budget Activity Codes all of which will refine the data search.

Once you know the specific information outlined above for the naval program, follow the link 'Navy Budget Documentation' found under the 'Links to Budget Material' header on the right side of the screen ensuring to have first selected the appropriate YEAR tab. Once again, select the appropriate budget authority for the program. Depending on which budget authority selected there may be a choice of different volumes representing selected budget activity codes (BA 1 to 7) or distinctions by Navy and Marine Corps. The final step is to search the document for the specific program. Try utilizing the nomenclature or program element number to locate the justification data. Do not be surprise if a program influences multiple program elements. Sorting through these differences will account for a majority of research labor hours exhausted.

Each budget item justification submitted follows roughly the same outlined format:

- Mission Description and Budget Item Justification
- Program Change Summary
- Accomplishments / Planned Program
- Other Program Funding Summary
- Acquisition Strategy
- Cost Analysis
- Schedule Profile
- Schedule Detail

Congressional reductions, rescissions, undistributed reductions, and increases account for a majority of the 'Program Change Summary' along with economic assumptions or miscellaneous adjustments. The 'Accomplishments and Planned Program' section provides a brief description and accounting breakdown of product development, support development, test & evaluation, program management support, and software support. The 'Other Program Funding Summary' will alert reviews to other programs, which have an effect and directly relate to the program. The 'Cost Analysis' section briefs the cost categories (product, support, test & evaluation, management) for contract method and type, performing activity and location, award and completion dates. The 'Schedule Profile and Detail' provide quarterly information, spanning eight fiscal years, for Milestones, Operational Evaluations, Low-rate and Full-rate production and including anticipated delivery numbers. This data would be ideal for studying the scheduling delays associated with a program.

2. Selected Acquisition Report

Beginning in 1969, the Department of Defense (DoD) began reporting to Congress the status of major weapon system acquisitions through Selected Acquisition Report (SAR). The SAR is a comprehensive report that contains information on the cost, schedule, and performance of major weapon systems in comparison with baseline values established at the demonstration/validation, full-scale development, and production decision points.[50] United States Code Title 10, Section 2432 Selected Acquisition Reports, defines standard terms, submission timelines for status reports, reporting waivers or exemption criteria, and reporting requirements.

The Deputy to the Director, Acquisition Resources & Analysis/Acquisition Management (ARA/AM) is responsible for maintaining and updating Selected Acquisition Reports (SAR). The ARA/AM website, where the "SAR Summary Tables" are located, is at http://www.acq.osd.mil/ara/am/sar/index.html. There are 130 reports accessible through the website for the period of December 1960 until June 2007. As

[50] DoD Instruction 7000.3-G, "Preparation and Review of Selected Acquisition Reports," May 1980, Defense Technical Information Center, DTIC: AD-A267 936.

directed in USC Title 10, all MDAPs are required to submit a report at the end of the fiscal year first quarter. Reporting during the second, third, and fourth quarter of the fiscal year is not required if the program meets the following criteria: less than a 15 percent increase in PAUC and current PUC; and less than a six month delay in any of the program milestone schedule; and a report was submitted during a previous period. Fiscal year waivers can only be authorized by the Secretary of Defense if (1) the program has not entered SDD; (2) a reasonable cost estimate has not been established; and (3) the system configuration is not well defined.

There are five sections addressed in each quarterly Summary (1) SAR Narrative Highlights, (2) Program Acquisition Cost; (3) Distribution of Cost Changes – Base-Year Dollars, (4) Distribution of Cost Changes – Then-Year Dollars, and (5) Program Funding Status. Each of these sections are discussed further.

Table 10. Sample SAR Narrative Highlights – Reported June 30, 2007

		Current Estimate ($ in Millions)
December 2006 (89 Programs)		**$1,683,973.8**
Less final reports on two programs		-5,568.4
Plus six new programs		11,096.6
December 2006 Adjusted (93 programs)		**$1,689,502.0**
Changes Since Last Report:		
Economic		0.0
Quantity		8.3
Schedule		842.8
Engineering		0.0
Estimating		3,039.3
Other		0.0
Support		381.0
	Net Cost Change	$4,271.4
June 2007 (93 programs)		**$1,693,773.4**

The ‘SAR Narrative Highlights’ begin by recapping the previous reported quarter’s current estimate of all the program acquisition costs and total number of programs. Two adjustments account for the reduction in cost for programs that submitted their final reports last period and for any additions in cost for programs submitting their first SAR report during this quarter. The ‘Net Cost Change’ is the total changes since the last report for those programs carrying over as seen in the six distribution categories: economic, quantity, schedule, engineering, estimating, support, and other, for all reported programs.

If a program breaches the “Significant Cost Growth Threshold,” see Table 9, then a quarterly exception SAR is submittals and listed by service (Navy, Army, and Air Force) or multi-service defense programs.

Table 11. Sample Table Header – SAR Program Acquisition Cost Summary

Weapon System	Base Year	Type of Baseline	Baseline Estimate			Changes to Date			Current Estimate			Percent Cost Change To Date Adjust for Qty	
			Cost		Quantity	Cost		Quantity	Cost		Quantity		
			Base Year $	Current Year $		Base Year $	Current Year $		Base Year $	Current Year $		Base Year $	Current Year $

The first table is the “Program Acquisition Cost Summary,” listed by service, then alphabetized by weapon system, a two digit base year and type of Baseline round out the first three columns. The type of baseline is a reflection of where the program is within the acquisition system management framework: DE or PdE, which represent development/Milestone II or production/engineering/Milestone III, respectively. Cost estimates are represented in both Base Year Dollars and Current Year Dollars. Along with quantity, presenting the data in both base and current dollars allows the reviewer to check whether threshold limitations of the Nunn-McCurdy Amendment have been breached. The ‘current estimate’ calculations follow the formula:

(Baseline Estimate) - (Changes To Date) = (Current Estimate)

Finally, the 'Percent Cost Change to Date' is calculated for both Base Year $ (BY$) and Current Year $ (CY$). The percent cost change is adjusted for quantity if program units have changed since Baseline Estimates.

The second table published in the SAR is the "Distribution of Cost Changes – Base-Year Dollars." This table shows the representation of the cost variance distribution of the total "Cost Changes to Date" presented in the "Program Acquisition Cost Summary" table of the SAR. These categories are defined in Table 12.

Table 12. Cost Variance Categories in Distribution Changes[51]

COST VARIANCE CATEGORIES	
Economic	Changes due solely to operation of the economy or indices
Quantity	Changes limited to end items of equipment for which PAUC or PUC reporting is required.
Schedule	Changes that affect the delivery schedule, procurement schedule, completion date or milestones for development or production
Engineering	Changes in the development of a system or item to be delivered, physically or functionally altered.
Estimating	Changes in the program cost due to a correction of error in preparing the DE or PdE, refinement of prior CE, or a change in program or cost estimating assumptions and techniques not provided for in the Quantity, Engineering, Schedule, or Support variance categories.
Other	Changes in program cost for reasons not provided for in the other cost variance categories; acts of God, work stoppage, federal or state law changes, unforeseeable events.
Support	Changes in cost, regardless of reason, associated with any work breakdown structure element associated with training and training equipment, peculiar support equipment, data, operational or site activation, and initial spares and repair parts.

[51] DoD Instruction 7000.3-G, "Preparation and Review of Selected Acquisition Reports," May 1980, Defense Technical Information Center, DTIC: AD-A267 936, pp. 3-5.

Table 13 is an example of the table header for a SAR Distribution of Cost Changes.

Table 13. Sample Table Header – SAR Distribution of Cost Changes

Weapon System	Base Year	Quantity		Schedule		Engineering		Estimating		Other		Support		Total	
		This Qtr	To Date	This Qtr	To Date	This Qtr	To Date	This Qtr	To Date	This Qtr	To Date	This Qtr	To Date	This Qtr	To Date

The distribution changes are cost variance categories utilized to track the program monetary increases or decreases and definition provided below. The" Economic" cost variance category is only found on the Then-Year table to account for inflation or economic indices that a program would not be able to control over the programs Life Cycle. The third table is Distribution of Cost Changes – Then-Year Dollars and is set up just like the Base-Year Dollars.

The final data reported in the SAR is the "Program Funding Status" where the total current year cost estimate is broken down into the prior-year expenditures, the anticipatory budgeting for the next two years, and the remaining balance of the program not yet budget or expended.

Table 14. Sample Table Header – SAR Program Funding Status

Weapon System	Prior Years	FY 2008 Budget	FY 2009 Budget	Balance of Program	Total

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IV. DATA, ANALYSIS AND RECONCILIATION

A. COMPTROLLER DATA

Comptroller data is published as part of the President's Budget (PB) in the month of February. The H-1 Upgrade Program funding data is submitted as both an RDT&E and a Procurement Program. Since this program is reported under more than one Budget Authority (BA) it is necessary to collect both programs activities reported in the PB and add them together to represent the programs total costs.

Program Total Costs = RDT&E + APN

1. Research Development Test & Evaluation Budget Item Justification

The H-1 data are reported under the System Development & Demonstration Activity corresponding to a Budget Activity Code of 05 (BA-5).

Table 15. RDT&E Budget Activity Codes

Budget Activity Code	Activity
01	Basic Research
02	Applied Research
03	Advanced Technology Development
04	Advanced Component Development & Prototypes
05	System Development & Demonstration
06	RDT&E Management Support
07	Operational System Development

It is important to note that the program RDT&E documents still refers to Engineering and Manufacturing Development (EMD) vice SDD. Program Element Number is 0604245N and Program Element Title is 'USMC H-1 Upgrade'. Though Milestone II was entered in 1996, RDT&E data on the comptroller site is only available as far back as FY 2000, reported in February 1999.

The compilation of a total of nine years of budgetary records, Table 16, provided the data utilized during the breach and reconciliation analysis. Each row represents a record of data reported for a specific fiscal year, column 1, and the date reported, column 2, in the President's Budget. All unit amounts are in millions of dollars.

Table 16. RDT&E Budget Item Justification Data -- $ Millions

FY	Report Date	PriorY97	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005
2000	Feb-99	79.019	81.290	120.254	157.683	108.820	50.023	19.876	12.758	
2001	Feb-00	79.019	81.290	116.746	183.266	139.680	48.960	18.286	9.451	
2002	Jun-01	79.019	81.290	116.746	178.524	138.189	170.068			
2003	Feb-02	79.019	81.290	116.746	178.556	133.324	170.448	241.384	80.547	54.506
2004	Feb-03	79.019	81.290	116.746	178.556	133.324	167.706	236.039	90.589	61.174
2005	Feb-04	79.019	81.290	116.746	178.556	133.324	167.456	232.229	90.965	90.389
2006	Feb-05	79.019	81.290	116.746	178.556	133.324	167.456	232.229	98.412	173.046
2007	Feb-06	79.019	81.290	116.746	178.556	133.324	167.456	232.229	100.719	168.171
2008	Feb-07	79.019	81.290	116.746	178.556	133.324	167.456	232.229	100.719	168.171

FY	Report Date	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	Total RDT&E Cost [$M]
2000	Feb-99									629.723
2001	Feb-00									676.698
2002	Jun-01									763.836
2003	Feb-02									1135.820
2004	Feb-03	11.168	8.035	3.831	3.836					1171.313
2005	Feb-04	10.907	7.723	3.525	3.525					1195.654
2006	Feb-05	42.012	7.700	3.620	3.680	3.815	3.940			1324.845
2007	Feb-06	41.382	7.844	3.656	3.832	3.970	3.767			1321.961
2008	Feb-07	57.846	7.814	3.608	3.851	3.989	3.776	3.825	3.885	1346.104

The nine records of data required 13 columns and due to the length required separation into two sections for presentation. Data provided in each record or row represents either an existing budgeted amount or an estimated amount for the future. Budgetary records reported up to seven years of data, prior/current budgeted fiscal years and the next five fiscal years as estimates. The President's Budget is for the next fiscal year and reported in the February prior. The FY 2002 PB data was not report until June 2001. The record does not address the late reporting date, but this period was immediately prior to the program threshold breach and the data may have been updated as part of or anticipation of the congressional certification process. The final column, titled 'Total RDT&E Cost' is the summation of the justification data report from PriorY97 to FY2013 for each recorded year.

2. Aircraft Procurement Budget Item Justification

H-1 aircraft procurement data are reported under the Modification of Aircraft Activity corresponding to a Budget Activity Code of 05 (BA-5).

Table 17. Procurement Budget Activity Codes

Budget Activity Code	Activity
01	Combat Aircraft
02	Airlift Aircraft
03	Trainer Aircraft
04	Other Aircraft
05	Modification of Aircraft
06	Aircraft Spares and Repair Parts
07	Aircraft Support Equipment & Facilities

Five years of procurement data are available on the comptroller site starting with FY 2003, reported on February 2002, until FY 2008, reported on February 2008. Table 18 provides this data with each record represented in the rows. Data from each record that is budgeted or estimated by fiscal year are arranged in groups.

Table 18. Aircraft Procurement Budget Item Justification Data — $ Millions

FY	Report Date	FY2001					FY2002					FY2003				
		# A/C	Wpn Sys Cost [$M]	Initial Spares [$M]	Proc Cost [$M]	Unit Cost [$M]	# A/C	Wpn Sys Cost [$M]	Initial Spares [$M]	Proc Cost [$M]	Unit Cost [$M]	# A/C	Wpn Sys Cost [$M]	Initial Spares [$M]	Proc Cost [$M]	Unit Cost [$M]
2000	Feb-99						5	85.340			17.068	17	228.584			13.446
2001	Feb-00						5	125.624			25.125	17	223.166			13.127
2003	Feb-02		5.987		5.987											
2004	Feb-03		5.987		5.987											
2005	Feb-04		5.987		5.987											
2006	Feb-05		5.987		5.987							0				
2007	Feb-06															
2008	Feb-07															

FY	Report Date	FY 2004					FY2005					FY2006				
		# A/C	Wpn Sys Cost [$M]	Initial Spares [$M]	Proc Cost [$M]	Unit Cost [$M]	# A/C	Wpn Sys Cost [$M]	Initial Spares [$M]	Proc Cost [$M]	Unit Cost [$M]	# A/C	Wpn Sys Cost [$M]	Initial Spares [$M]	Proc Cost [$M]	Unit Cost [$M]
2000	Feb-99	24	307.418		307.418	12.809	36	386.017		386.017	10.723					
2001	Feb-00	24	308.985		308.985	12.874	36	377.131		377.131	10.476					
2003	Feb-02	9	282.824	43.282	326.106	36.234	11	254.568	80.053	334.621	30.420	22	416.022	166.830	582.852	26.493
2004	Feb-03	9	310.799	20.138	330.937	36.771	7	200.420	11.089	211.509	30.216	14	338.645	16.670	355.315	25.380
2005	Feb-04	9	308.492	16.180	324.672	36.075	9	241.792	9.088	250.880	27.876	12	337.685	29.394	367.079	30.590
2006	Feb-05	9	308.562	19.034	327.596	36.400	7	198.858	16.581	215.439	30.777	10	307.479	51.081	358.560	35.856
2007	Feb-06 (1)	9	319.110	15.878	334.988	37.221	7	213.061	15.384	228.445	32.635	10	314.450	36.994	351.444	35.144
2008	Feb-07	9	319.110	15.878	334.988	37.221	7	213.061	15.384	228.445	32.635	7	314.011	41.075	355.086	50.727

FY	Report Date	FY2007					FY2008					FY2009				
		# A/C	Wpn Sys Cost [$M]	Initial Spares [$M]	Proc Cost [$M]	Unit Cost [$M]	# A/C	Wpn Sys Cost [$M]	Initial Spares [$M]	Proc Cost [$M]	Unit Cost [$M]	# A/C	Wpn Sys Cost [$M]	Initial Spares [$M]	Proc Cost [$M]	Unit Cost [$M]
2000	Feb-99															
2001	Feb-00															
2003	Feb-02	28	465.283	142.053	607.336	21.691										
2004	Feb-03	23	453.639	78.670	532.309	23.144	23	466.531	86.222	552.753	24.033	24	473.842	0.332	474.174	19.757
2005	Feb-04	19	431.934	48.415	480.349	25.282	21	467.211	84.461	551.672	26.270	21	454.563	0.000	454.563	21.646
2006	Feb-05	18	434.942	48.417	483.359	26.853	21	471.633	75.161	546.794	26.038	21	443.578	41.921	485.499	23.119
2007	Feb-06	18	446.718	74.937	521.655	28.981	19	440.817	12.676	453.493	23.868	23	484.852	3.896	488.748	21.250
2008	Feb-07 (2)	11	443.805	51.588	495.393	45.036	20	518.475	61.718	580.193	29.010	25	564.421	27.304	591.725	23.669

FY	Report Date	FY2010					FY2011					FY2012				
		# A/C	Wpn Sys Cost [$M]	Initial Spares [$M]	Proc Cost [$M]	Unit Cost [$M]	# A/C	Wpn Sys Cost [$M]	Initial Spares [$M]	Proc Cost [$M]	Unit Cost [$M]	# A/C	Wpn Sys Cost [$M]	Initial Spares [$M]	Proc Cost [$M]	Unit Cost [$M]
2000	Feb-99															
2001	Feb-00															
2003	Feb-02															
2004	Feb-03															
2005	Feb-04															
2006	Feb-05	22	482.196	47.909	530.105	24.096	23	501.740	47.866	549.606	23.896					
2007	Feb-06	23	503.940	7.650	511.590	22.243	23	504.865	7.650	512.515	22.283					
2008	Feb-07	28	644.200	9.624	653.824	23.351	28	645.595	24.616	670.211	23.936	24	554.846	0.000	554.846	23.119

FY	Report Date	FY2013					Total FY 2002 - 2013					To Complete		Total			% Increase from previous year
		# A/C	Wpn Sys Cost [$M]	Initial Spares [$M]	Proc Cost [$M]	Unit Cost [$M]	# A/C	Wpn Sys Cost [$M]	Init. Spares [$M]	Proc Cost [$M]	Unit Cost [$M]	# A/C	Cost	A/C	Program Cost	$ per A/C	
2000	Feb-99						82	1007.359	0.000	693.435	12.285	198	1922.629	280	2929.988	10.46	0
2001	Feb-00						82	1034.906	0.000	686.116	12.621	198	1902.343	280	2937.249	10.49	0.25%
2003	Feb-02						70	1424.684	432.218	1856.902	26.527	210	3253.038	280	5109.940	18.25	**73.97%**
2004	Feb-03						100	2249.863	213.121	2462.984	24.630	180	3097.808	280	5560.792	19.86	8.82%
2005	Feb-04						91	2247.664	187.538	2435.202	26.760	189	3206.825	280	5642.027	20.15	1.46%
2006	Feb-05						131	3154.975	347.970	3502.945	26.740	149	3173.163	280	6676.108	23.84	18.33%
2007	Feb-06						132	3227.813	175.065	3402.878	25.779	148	3234.058	280	6636.936	23.70	-0.59%
2008	Feb-07	24	563.713	0.000	563.713	23.488	183	4781.237	247.187	5028.424	27.478	97	2331.933	280	7360.357	26.29	10.90%

(1) $10.8 M received in FY 2006 Title IX funding
(2) $68.6 M received in FY 2007 Title IX for 3 aircraft

Each group has five columns of data: number of aircraft, weapon system cost, initial spares, procurement cost, and unit cost. Weapon system costs include, but limited to, the cost of the airframe, engines, publications, production engineering support, armament, and facilities management. "Initial spares are deliverable spare components, assemblies and subassemblies used for initial replacement purposes in the materiel system equipment end item. For example repairable spares and repair parts required as initial stockage to support and maintain newly fielded systems or subsystems during the initial phase of service, including pipeline and war reserve quantities, at all levels of maintenance and support."[52] Procurement costs are equal to weapon system costs plus initial spares.

Proc Cost = Wpn Sys Cost + Initial Spares

Unit costs in each grouped fiscal year data is for that specific year only. After the FY2013 data group, all records are summed to provide a 'Total for FY2001 through FY 2013. The 'To Complete' aircraft numbers and costs is the dollar amount estimated and projected for the years beyond the last fiscal year reported for that record. For example, the FY2004, Report Date Feb-03, has data budgeted and estimated for FY2004 through FY2009. The 'Total Program Cost will equal FY2004 through FY2009 plus the remaining to complete costs.

Total Program Cost = (Total FY2004 thru FY2009) + To Complete

B. SELECTED ACQUISITION REPORT SUMMARY DATA

The DoD submitted the initial SAR for H-1 Upgrade Program in the December 1996. The baseline established on the program from this point reported at $3,571.3 Million. Data from 29 records, spanning 11-years, from the following three SAR tables provide the necessary data to analyze threshold breaches and reconciliation: Program Acquisition Cost Summary, Distribution of Cost Changes BY$, and Program Funding Status. Program Officials submitted SAR data three times a year: June, September, and December, though in most cases changes only occurred in the month of December.

[52] Department of Defense Handbook, "Work Breakdown Structures for Defense Materiel Items," MIL-HDBK-881A: 30 July 2005, p126, http://www.acq.osd.mil/ pm/currentpolicy/wbs/MIL_HDBK-881A/MILHDBK881A/ WebHelp3/MILHDBK881A.htm (accessed November 2007).

Missing from the records is data between the period of September 2000 and September 2001. Again, this period was immediately prior to the program threshold breach and the data may have been updated as part of, or in anticipation to, the congressional certification process. Tables 19 through 21 present the data as submitted in the SAR and provide a consolidated format for reporting and analysis.

Table 19. Program Acquisition Cost Summary Data From June 1997 to June 2007

Date	Base Year	Type of Baseline	Baseline Estimate			Changes to Date			Current Estimate			Percent Cost Change To Date Adjust for Qty	
			Cost		Quantity	Cost		Quantity	Cost		Quantity		
			Base Year $	Current Year $		Base Year $	Current Year $		Base Year $	Current Year $		Base Year $	Current Year $
30-Jun-97	96	DE	2,792.5	3,547.5	284	-4.8	23.8		2787.7	3571.3	284	-0.2	0.7
25-Sep-97	96	DE	2,792.5	3,547.5	284	-4.8	23.8		2787.7	3571.3	284	-0.2	0.7
31-Dec-97	96	DE	2,792.5	3,547.5	284	17.7	-117		2,810.2	3,430.5	284	0.6	-3.3
30-Jun-98	96	DE	2,792.5	3,547.5	284	17.7	-117		2,810.2	3430.5	284	0.6	-3.3
30-Sep-98	96	DE	2,792.5	3,547.5	284	17.7	-117		2810.2	3430.5	284	0.6	-3.3
31-Dec-98	96	DE	2,792.5	3,547.5	284	264.9	96.2		3057.4	3643.7	284	9.5	2.7
30-Jun-99	96	DE	2,792.5	3,547.5	284	264.9	96.2		3057.4	3643.7	284	9.5	2.7
30-Sep-99	96	DE	2,792.5	3,547.5	284	264.9	96.2		3057.4	3643.7	284	9.5	2.7
31-Dec-99	96	DE	2,792.5	3,547.5	284	377.1	183.5		3169.6	3731	284	13.5	5.2
30-Jun-00	97	DE	2,792.5	3,547.5	284	377.1	183.5		3169.6	3731	284	13.5	5.2
30-Sep-00	96	DE	2,792.5	3,547.5	284	377.1	183.5		3169.6	3731	284	13.5	5.2
30-Sep-01	96	DE	2,792.5	3,547.5	284	330.4	163.4	-5	3122.9	3710.9	279	11.8	4.6
31-Dec-01	96	DE	2,792.5	3,547.5	284	2350.7	2687.1		5143.2	6234.6	284	84.2	75.7
30-Jun-02	96	DE	2,792.5	3,547.5	284	2350.7	2687.1		5143.2	6234.6	284	84.2	75.7
30-Sep-02	96	DE	2,792.5	3,547.5	284	2350.7	2687.1		5143.2	6234.6	284	84.2	75.7
31-Dec-02	96	DE	2,792.5	3,547.5	284	2785.4	3173.7		5577.9	6721.2	284	99.7	89.5
30-Jun-03	96	DE	2,792.5	3,547.5	284	2785.4	3173.7		5577.9	6721.2	284	99.7	89.5
30-Sep-03	96	DE	2,792.5	3,547.5	284	2785.4	3173.7		5577.9	6721.2	284	99.7	89.5
31-Dec-03	96	DE	2,792.5	3,547.5	284	2853	3279.8		5645.5	6827.3	284	102.2	92.5
30-Jun-04	96	DE	2,792.5	3,547.5	284	2853	3279.8		5645.5	6827.3	284	102.2	92.5
30-Sep-04	96	DE	2,792.5	3,547.5	284	2853	3279.8		5645.5	6827.3	284	102.2	92.5
31-Dec-04	96	DE	2,792.5	3,547.5	284	3503.7	4457		6296.2	8004.5	284	125.5	125.6
30-Jun-05	96	DE	2,792.5	3,547.5	284	3503.7	4457		6296.2	8004.5	284	125.5	125.6
30-Sep-05	96	DE	2,792.5	3,547.5	284	3528.9	4485.3		6321.4	8032.8	284	126.4	126.4
31-Dec-05	96	DE	2,792.5	3,547.5	284	3425.4	4467.8		6217.9	8015.3	284	122.7	125.9
30-Jun-06	96	DE	2,792.5	3,547.5	284	3425.4	4467.8		6217.9	8015.3	284	122.7	125.9
30-Sep-06	96	DE	2,792.5	3,547.5	284	3425.4	4467.8		6217.9	8015.3	284	122.7	125.9
31-Dec-06	96	DE	2,792.5	3,547.5	284	3902	5159		6694.5	8706.5	284	139.7	145.4
30-Jun-07	96	DE	2,792.5	3,547.5	284	3902	5159		6694.5	8706.5	284	139.7	145.4

Table 20. Distribution of Cost Change From June 1997 to June 2007 – BY Dollars

Date	Base Year	Quantity		Schedule		Engineering		Estimating		Other		Support		Total	
		This Qtr	To Date	This Qtr	To Date	This Qtr	To Date	This Qtr	To Date	This Qtr	To Date	This Qtr	To Date	This Qtr	To Date
30-Jun-97	96				-4.8									-4.8	-4.8
25-Sep-97	96				-4.8										-4.8
31-Dec-97	96				-4.8	22.4	22.4	0.1	0.1					22.5	17.7
30-Jun-98	96				-4.8		22.4		0.1						17.7
30-Sep-98	96				-4.8		22.4		0.1						17.7
31-Dec-98	96				-4.8	198.4	220.8	21.0	21.0			27.9	27.9	247.3	264.9
30-Jun-99	96				-4.8		220.8		21.0				27.9		264.9
30-Sep-99	96				-4.8		220.8		21.0				27.9		264.9
31-Dec-99	96				-4.8		220.8	45.8	66.8			66.4	94.3	112.2	377.1
30-Jun-00	96				-4.8		220.8		66.8				94.3		377.1
30-Sep-00	96				-4.8		220.8		66.8				94.3		377.1
30-Sep-01	96				-4.8		220.8	12.2	79.0			-58.9	35.4	-46.7	330.4
31-Dec-01	96			32.6	27.8	139.2	360.0	1,401.6	1,480.6			446.9	482.3	2,020.3	2,350.7
30-Jun-02	96				27.8		360.0		1,480.6				482.3		2,350.7
30-Sep-02	96				27.8		360.0		1,480.6				482.3		2,350.7
31-Dec-02	96			5.3	33.1	21.4	381.4	501.6	1,982.2			-93.6	388.7	434.7	2,785.4
30-Jun-03	96				33.1		381.4		1,982.2				388.7		2,785.4
30-Sep-03	96				33.1		381.4		1,982.2				388.7		2,785.4
31-Dec-03	96			28.9	62.0		381.4	-120.1	1,862.1			158.8	547.5	67.6	2,853.0
30-Jun-04	96				62.0		381.4		1,862.1				547.5		2,853.0
30-Sep-04	96				62.0		381.4		1,862.1				547.5		2,853.0
31-Dec-04	96			97.5	159.5	87.4	468.8	157.3	2,019.4			308.5	856.0	650.7	3,503.7
30-Jun-05	96				159.5		468.8		2,019.4				856.0		3,503.7
30-Sep-05	96				159.5		468.8	10.8	2,030.2			14.4	870.4	25.2	3,528.9
31-Dec-05	96				159.5		468.8	34.0	2,064.2			-137.5	732.9	-103.5	3,425.4
30-Jun-06	96				159.5		468.8		2,064.2				732.9		3,425.4
30-Sep-06	96				159.5		468.8		2,064.2				732.9		3,425.4
31-Dec-06	96			18.5	178.0		468.8	381.5	2,445.7			76.6	809.5	476.6	3,902.0
30-Jun-07	96				178.0		468.8		2,445.7				809.5		3,902.0

Table 21. Program Funding Status From June 1997 to June 2007

Date	Prior Year	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09	Total Funding Status [PY+FY]	Balance of Program	Total Report
30-Jun-97	70	80.7	90.3											241.0	3,330.3	3,571.3
30-Sep-97	70	80.7	90.3											241.0	3330.3	3571.3
31-Dec-97	68.1	83.6	98.5											250.2	3,180.3	3,430.5
30-Jun-98	68.1	83.6	98.5											250.2	3,180.3	3,430.5
30-Sep-98	68.1	83.6	98.5											250.2	3,180.3	3,430.5
31-Dec-98	269.5			157.7	109.6									536.8	3,106.9	3,643.7
30-Jun-99	269.5			157.7	109.6									536.8	3,106.9	3,643.7
30-Sep-99	269.5			157.7	109.6									536.8	3,106.9	3,643.7
31-Dec-99	266.1			183.3	139.7									589.1	3,141.9	3,731.0
30-Jun-00	266.1			183.3	139.7									589.1	3141.9	3731
30-Sep-00	266.1			183.3	139.7									589.1	3,141.9	3,731.0
30-Sep-01	583.8					170.1	269.6							1,023.5	2,687.4	3,710.9
31-Dec-01	583.8					170.5	241.4							995.7	5,238.9	6,234.6
30-Jun-02	583.8					170.5	241.4							995.7	5,238.9	6,234.6
30-Sep-02	583.8					170.5	241.4							995.7	5,238.9	6,234.6
31-Dec-02	987.7							421.5	272.7					1,681.9	5,039.3	6,721.2
30-Jun-03	987.7							421.5	272.7					1,681.9	5,039.3	6,721.2
30-Sep-03	987.7							421.5	272.7					1,681.9	5,039.3	6,721.2
31-Dec-03	983.9							415.7	341.3					1,740.9	5,086.4	6,827.3
30-Jun-04	983.9							415.7	341.3					1,740.9	5,086.4	6,827.3
30-Sep-04	983.9							415.7	341.3					1,740.9	5,086.4	6,827.3
31-Dec-04	1,812.7									400.6	491.1			2,704.4	5,300.1	8,004.5
30-Jun-05	1,812.7									400.6	491.1			2,704.4	5,300.1	8,004.5
30-Sep-05	1,823.3									400.5	502.5			2,726.3	5,306.5	8,032.8
31-Dec-05	1,826.5									392.9	529.4			2,748.8	5,266.5	8,015.3
30-Jun-06	1,826.5									392.9	529.4			2,748.8	5,266.5	8,015.3
30-Sep-06	1,826.5									392.9	529.4			2,748.8	5,266.5	8,015.3
31-Dec-06	2,737.1											583.8	595.6	3,916.5	4,790.0	8,706.5
30-Jun-07	2,737.1											583.8	595.6	3,916.5	4,790.0	8,706.5

C. ANALYSIS AND RECONCILIATION

Analysis of the data will provide answers to (1) how recent acquisition reform of the Nunn-McCurdy Thresholds affected the program, (2) whether cost increases have stabilized, (3) contributions of cost variance categories, and (4) investigations into reconciliation between SAR and PB data.

1. Analysis

In order to research the effects of the cost threshold changes of the FY2006 NDAA, calculate the Program Acquisition Unit Cost (PAUC) Growth from one year to the next and then translated into a percent change.

$$\text{PAUC Growth, \%} = \frac{(\text{CE PAUC} - \text{BE PAUC})}{\text{BE PAUC}} * 100 \qquad \text{where,}$$

$$\text{Current Estimate (CE) PAUC} = \frac{\text{Current Cost BY\$}}{\text{Current Quantity}}$$

$$\text{Baseline Estimate (BE) PAUC} = \frac{\text{Baseline Cost BY\$}}{\text{Baseline Quantity}}$$

Next, the percent change from one year to the next will provide the information needed to determine whether a significant or critical threshold was exceeded. As stated in Chapter III.C.2, Table 9, the threshold limits for the H-1 Upgrade Program are 30/50 because the program is still utilizing the 'original' Baseline Estimate from 1996.

$$\text{Change}_{\text{current to previous}} = \text{PAUC Growth}_{\text{current}} - \text{PAUC Growth}_{\text{previous}}$$

It is worth pointing out that a comparison of the 'PAUC Growths' calculated, Table 22, and the 'Percent Cost Change To Date', Table 18, reveals that these two pieces of calculated data seem to be the same. This has occurred because the H-1 program has not changed the quantity of aircraft since the original baseline. In programs were unit

quantities change, over the SDD life cycle, would most likely see different results for these two calculations. PAUC changes as unit quantity changes and Cost Changes do not take into consideration

Table 22. Program Acquisition Unit Cost (PAUC) Estimates and Growth From June 1997 to June 2007 in BY $

Date	Baseline Estimate PAUC [BY $]	Current Estimate PAUC [BY $]	PAUC Cost Growth [% in BY $]	Percent change from previous year
30-Jun-97	9.833	9.816	-0.17	
25-Sep-97	9.833	9.816	-0.17	0.00
31-Dec-97	9.833	9.895	0.63	0.81
30-Jun-98	9.833	9.895	0.63	0.00
30-Sep-98	9.833	9.895	0.63	0.00
31-Dec-98	9.833	10.765	9.49	8.85
30-Jun-99	9.833	10.765	9.49	0.00
30-Sep-99	9.833	10.765	9.49	0.00
31-Dec-99	9.833	11.161	13.50	4.02
30-Jun-00	9.833	11.161	13.50	0.00
30-Sep-00	9.833	11.161	13.50	0.00
30-Sep-01	9.833	11.193	13.84	0.33
31-Dec-01	9.833	18.110	84.18	70.34
30-Jun-02	9.833	18.110	84.18	0.00
30-Sep-02	9.833	18.110	84.18	0.00
31-Dec-02	9.833	19.640	99.75	15.57
30-Jun-03	9.833	19.640	99.75	0.00
30-Sep-03	9.833	19.640	99.75	0.00
31-Dec-03	9.833	19.879	102.17	2.42
30-Jun-04	9.833	19.879	102.17	0.00
30-Sep-04	9.833	19.879	102.17	0.00
31-Dec-04	9.833	22.170	125.47	23.30
30-Jun-05	9.833	22.170	125.47	0.00
30-Sep-05	9.833	22.258	126.37	0.90
31-Dec-05	9.833	21.894	122.66	-3.71
30-Jun-06	9.833	21.894	122.66	0.00
30-Sep-06	9.833	21.894	122.66	0.00
31-Dec-06	9.833	23.572	139.73	17.07
30-Jun-07	9.833	23.572	139.73	0.00

The PAUC Growth for each report submittal was plotted in Figure 4. The vertical jumps in the figure represent the major cost increases from one year to the next. Note the largest vertical rise from September 2001 to December 2001. This is the period when the H-1 Upgrade Program had their cost growth threshold breach. In December 2001, the PAUC increased by 70.3 percent from the previous year.

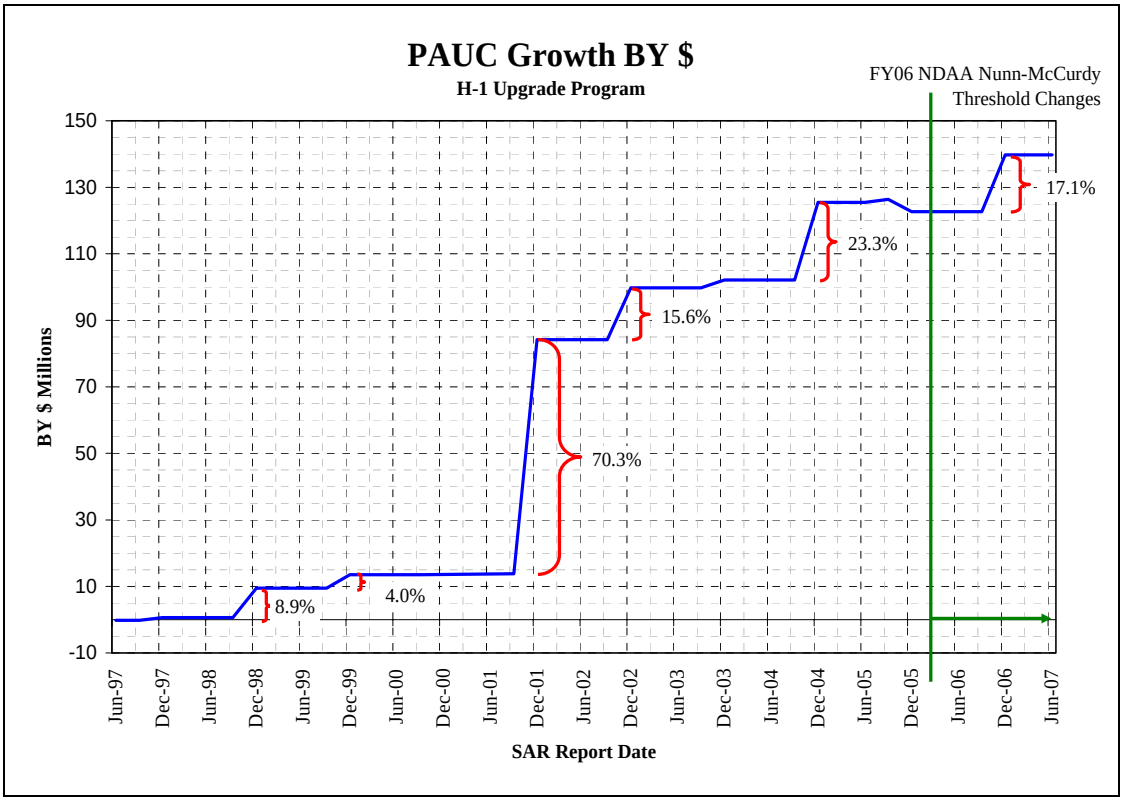

Figure 4. PAUC Growth BY $ H-1 Upgrade Program

During this time, program breaches were still regulated under the initial Nunn-McCurdy limits of 15/25, where increases of 15 percent require Congressional notification and 25 percent required SECDEF certification. The H-1 Upgrade Program breach explanation indicated the primary reasons were:[53]

- Revised estimates for development cost,
- Increased testing requirements,

[53] Defense Link News (2002), "Nunn-McCurdy (NM) Unit Cost Breaches," Published May 2002, http://www.defenselink.mil/news/may2002/d200020502.nme.pdf.

- Increased contractor overhead rates base on a contraction in business base,
- Increased estimate of production labor hours and
- Increased cost of material

The H-1 Program data analysis indicates only two more incidences of cost growth increases before the new regulations went into effect: December 2002 and December 2004. Both increases were above 15 percent but below 25 percent, lending to Congressional notification only and not requiring certification. The PAUC growth for CY$, Table 23, was also calculated to see if there was any substantial differences in the growth factors calculated utilizing base year $ verses current year $. A plot of the CY$ data, Figure 5, shows the similar pattern of increases to that of the BY$ data above.

Table 23. Program Acquisition Unit Cost (PAUC) Estimates and Growth from June 1997 to June 2007 in CY $

Date	Baseline Estimate PAUC [CY $]	Current Estimate PAUC [CY $]	PAUC Cost Growth [% in CY $]	Percent change from previous year
30-Jun-97	12.49	12.58	0.67	0.67
25-Sep-97	12.49	12.58	0.67	0.00
31-Dec-97	12.49	12.08	-3.30	-3.97
30-Jun-98	12.49	12.08	-3.30	0.00
30-Sep-98	12.49	12.08	-3.30	0.00
31-Dec-98	12.49	12.83	2.71	6.01
30-Jun-99	12.49	12.83	2.71	0.00
30-Sep-99	12.49	12.83	2.71	0.00
31-Dec-99	12.49	13.14	5.17	2.46
30-Jun-00	12.49	13.14	5.17	0.00
30-Sep-00	12.49	13.14	5.17	0.00
30-Sep-01	12.49	13.07	4.61	-0.57
31-Dec-01	12.49	21.95	75.75	71.14
30-Jun-02	12.49	21.95	75.75	0.00
30-Sep-02	12.49	21.95	75.75	0.00
31-Dec-02	12.49	23.67	89.46	13.72
30-Jun-03	12.49	23.67	89.46	0.00
30-Sep-03	12.49	23.67	89.46	0.00
31-Dec-03	12.49	24.04	92.45	2.99
30-Jun-04	12.49	24.04	92.45	0.00
30-Sep-04	12.49	24.04	92.45	0.00
31-Dec-04	12.49	28.18	125.64	33.18
30-Jun-05	12.49	28.18	125.64	0.00
30-Sep-05	12.49	28.28	126.44	0.80
31-Dec-05	12.49	28.22	125.94	-0.49
30-Jun-06	12.49	28.22	125.94	0.00
30-Sep-06	12.49	28.22	125.94	0.00
31-Dec-06	12.49	30.66	145.43	19.48
30-Jun-07	12.49	30.66	145.43	0.00

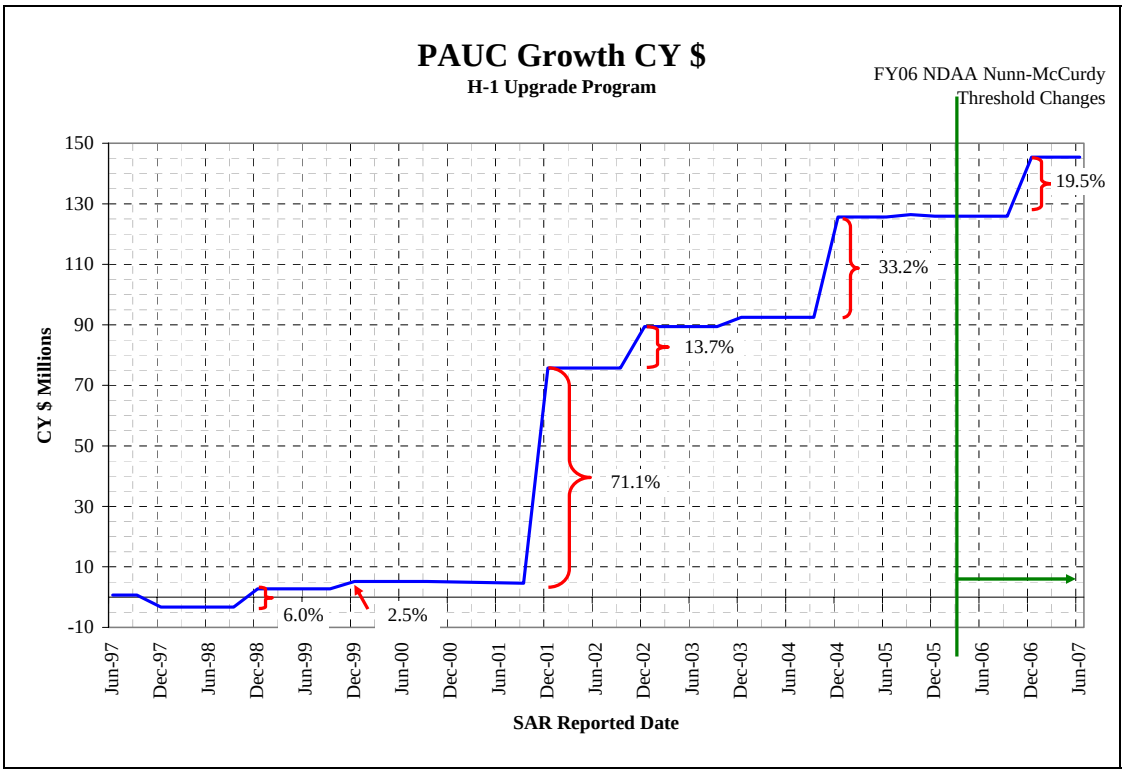

Figure 5. PAUC Growth CY $ H-1 Upgrade Program

A side-by-side comparison of the BY$ and CY$ growth values, Table 23, does highlight a few difference. The largest difference, during the December 2004 period, is a 10 point difference in the PAUC growth values when utilizing Base Year $ verses Current Year $. This difference causes the percent change in PAUC cost growth to rise beyond 30%, the reformed breach thresholds requiring Congressional notification. This diversity in BY$ and CY$ illustrates the possible difference that can be obtained when calculating threshold values and highlights the need to do both calculations. Research into the Nunn-McCurdy Threshold did not seem to isolate in which dollar values (Base Year or Current Year) that the Categories or Threshold values represented. Calculations only distinguished the requirement between original or current "Baseline Estimate" when determining threshold breaches with PAUC growth.

Table 24. BY$ and CY$ PAUC Growth Comparison

Date Reported	PAUC Differences	
	BY$	CY$
31-Dec-98	8.9	6.0
31-Dec-99	4.0	2.5
31-Dec-01	70.3	71.1
31-Dec-02	15.6	13.7
31-Dec-04	23.3	33.2
31-Dec-06	17.1	19.5

Is it possible to say from the PAUC values if the program has stabilized cost increases? If a program is still utilizing the original baseline year then threshold values at 30/50 might indicate stability as long as the program does not surpass the 'significant' threshold value. Since the program's threshold breach, reported in December 2001, the program has seen increases ranging from 15 to 23 in BY$. Exploring the impact of each cost variance category and their individual influences over the ranges further investigates into the stability of the program.

The seven cost variances are quantity, other, support, schedule, engineering, economic, and estimating. The H-1 program did not change the quantity of end items or aircraft to be procured, therefore, quantity is not considered as an influence in cost increases or instability. The program never reported 'other' change increases. Some consider both quantity and other changes as baseline cost changes that are considered beyond the control of the program manager; yet, many programs adjust quantity to offset or reduce actual dollar value increases in a program that would never be granted congressional budgetary increases. Economic and estimating changes are characterized as future costs growth that may or may not be realized. 'Actual' cost variances are represented by events from within supporting, scheduling, or engineering categories that have or will result in cost changes.

First, the cumulative change and percent cumulative total of each cost variance category was calculated. A stacked-area chart displaying the trend and cumulative contribution of each variance category, in relation to total costs reported, provides further explanations into the program instability and cost increases. It was necessary to build two separate graphs, one, representing the distribution prior to the breach in December 2001 and another after the breach. The cost increase was so drastic, after December 2001, that graphing the entire timeline together prevented seeing the individual category distributions in the early years of the SDD phase.

Table 25. Cost Variance Categories Percent Contribution to Cost Changes From June 1997 to June 2007

Date	Base Year	Schedule		Engineering		Estimating		Support		Total
		Cumulative Change	Percent Cumulative of Total	Cumulative Change	Percent Cumulative of Total	Cumulative Change	Percent Cumulative of Total	Cumulative Change	Percent Cumulative of Total	To Date
30-Jun-97	96	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.8
25-Sep-97	96	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.8
31-Dec-97	96	0.0	0.0	22.4	126.6	0.1	0.6	0.0	0.0	17.7
30-Jun-98	96	0.0	0.0	22.4	126.6	0.1	0.6	0.0	0.0	17.7
30-Sep-98	96	0.0	0.0	22.4	126.6	0.1	0.6	0.0	0.0	17.7
31-Dec-98	96	0.0	0.0	220.8	83.4	21.0	7.9	27.9	10.5	264.9
30-Jun-99	96	0.0	0.0	220.8	83.4	21.0	7.9	27.9	10.5	264.9
30-Sep-99	96	0.0	0.0	220.8	83.4	21.0	7.9	27.9	10.5	264.9
31-Dec-99	96	0.0	0.0	220.8	58.6	66.8	17.7	94.3	25.0	377.1
30-Jun-00	96	0.0	0.0	220.8	58.6	66.8	17.7	94.3	25.0	377.1
30-Sep-00	96	0.0	0.0	220.8	58.6	66.8	17.7	94.3	25.0	377.1
30-Sep-01	96	0.0	0.0	220.8	66.8	79.0	23.9	35.4	10.7	330.4
31-Dec-01	96	32.6	1.4	360.0	15.3	1,480.6	63.0	482.3	20.5	2,350.7
30-Jun-02	96	32.6	1.4	360.0	15.3	1,480.6	63.0	482.3	20.5	2,350.7
30-Sep-02	96	32.6	1.4	360.0	15.3	1,480.6	63.0	482.3	20.5	2,350.7
31-Dec-02	96	37.9	1.4	381.4	13.7	1,982.2	71.2	388.7	14.0	2,785.4
30-Jun-03	96	37.9	1.4	381.4	13.7	1,982.2	71.2	388.7	14.0	2,785.4
30-Sep-03	96	37.9	1.4	381.4	13.7	1,982.2	71.2	388.7	14.0	2,785.4
31-Dec-03	96	66.8	2.3	381.4	13.4	1,862.1	65.3	547.5	19.2	2,853.0
30-Jun-04	96	66.8	2.3	381.4	13.4	1,862.1	65.3	547.5	19.2	2,853.0
30-Sep-04	96	66.8	2.3	381.4	13.4	1,862.1	65.3	547.5	19.2	2,853.0
31-Dec-04	96	164.3	4.7	468.8	13.4	2,019.4	57.6	856.0	24.4	3,503.7
30-Jun-05	96	164.3	4.7	468.8	13.4	2,019.4	57.6	856.0	24.4	3,503.7
30-Sep-05	96	164.3	4.7	468.8	13.3	2,030.2	57.5	870.4	24.7	3,528.9
31-Dec-05	96	164.3	4.8	468.8	13.7	2,064.2	60.3	732.9	21.4	3,425.4
30-Jun-06	96	164.3	4.8	468.8	13.7	2,064.2	60.3	732.9	21.4	3,425.4
30-Sep-06	96	164.3	4.8	468.8	13.7	2,064.2	60.3	732.9	21.4	3,425.4
31-Dec-06	96	182.8	4.7	468.8	12.0	2,445.7	62.7	809.5	20.7	3,902.0
30-Jun-07	96	182.8	4.7	468.8	12.0	2,445.7	62.7	809.5	20.7	3,902.0

Average Before Breach	0.0	72.7	8.5	9.8
Average After Breach	3.1	13.7	63.4	20.0

Prior to the breach, the engineering cost variance accounted for, on average, more than 72% of the total cost increases recorded by the program. These changes represent the development of the system or items delivered that physically or functionally are

altered. During this period, schedule cost variances that affect delivery, procurement, and milestones were reported as not having had any influence on cost increase, zero percent. The remaining 28% of the average total cost increase is split between the supporting requirements and estimations due to correction of error in preparation of the prior cost estimate. Toward the end of 2000, supporting requirements began to account for a larger share of the two variances.

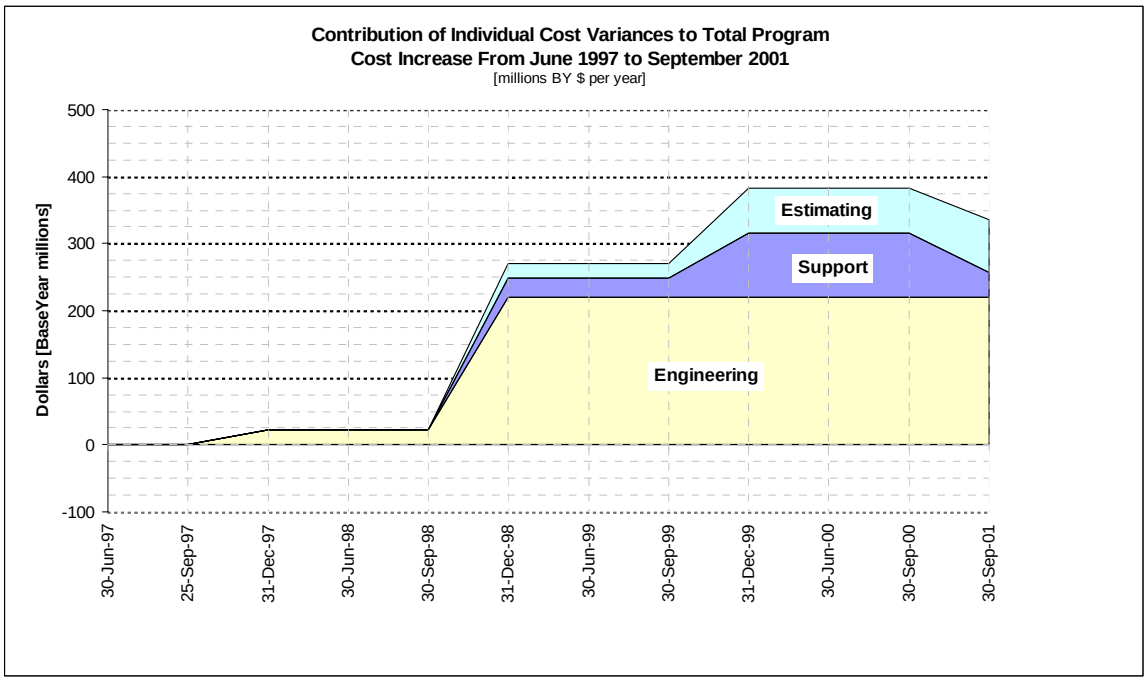

Figure 6. Contribution of Individual Cost Variances to Total Program Cost Increases From June 1997 to September 2001

After the breach period, more than 63% of the total cost increase on average was attributed to estimating changes. The baseline cost estimate has not been adjusted since the beginning of the program; therefore, most cost variances can be due to the major correction in the December 2001 estimate, and/or changes in program or cost estimating assumptions and techniques. Engineering and support variances attributed to, on average, approximately 14 and 20 percent of the cost variances, respectively. Engineering cost variances did not decrease; they were only offset by the large estimating increase after the breach. After the breach and an apparent reevaluation of program cost, the scheduling cost variance began to have its effect on approximately 3% of the total costs.

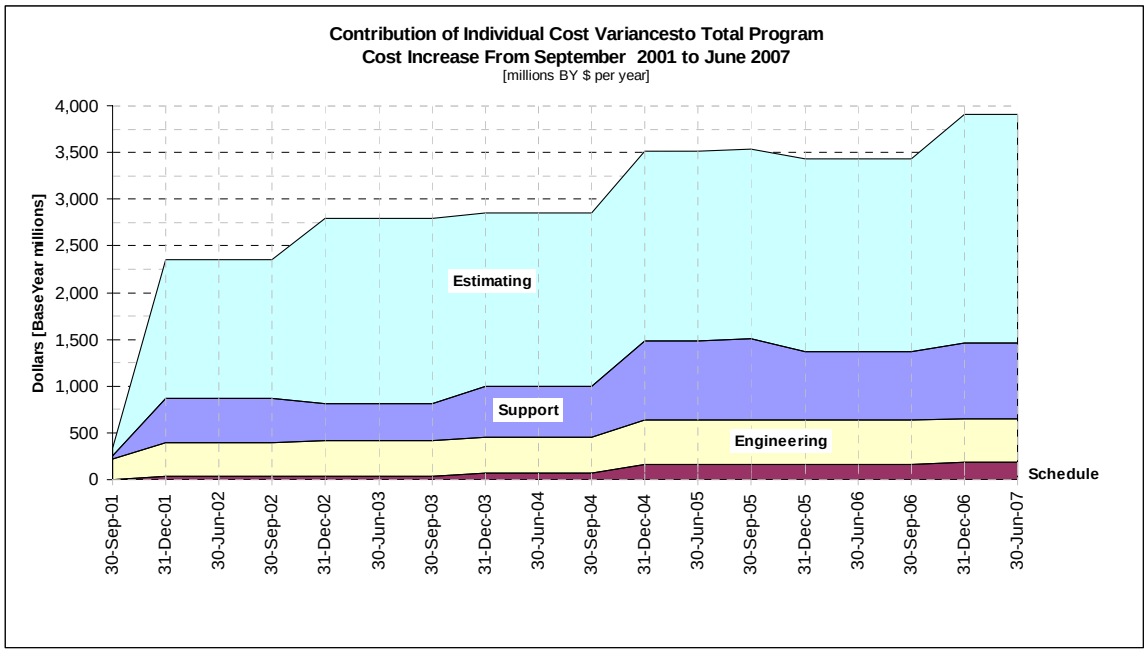

Figure 7. Contribution of Individual Cost Variances to Total Program Cost Increase From September 2001 to June 2007

2. SAR and President's Budget Reconciliation

"The Business Enterprise Architecture (BEA) is part of the enterprise architecture for the Department of Defense Business Mission Area (BMA) and includes activities, processes, data standards, business rules, operating requirements, and information exchanges. The transformation effort guiding BEA development focuses on providing tangible outcomes for a limited set of priorities and on developing an architecture that is integrated, understandable, and actionable."[54] Six Business Enterprise Priorities define these: Acquisition Visibility (AV), Common Supplier Engagement (CSE), Financial Visibility (FV), Materiel Visibility (MV), Personnel Visibility (PV), and Real Property Accountability (RPA).

> Acquisition Visibility is defined as achieving timely access to accurate, authoritative, and reliable information supporting acquisition oversight,

[54] Business Transformation Agency, "BEA 4.1 Summary," March 15, 2007, http://www.defenselink.mil/DBT/products/2007_BEA_ETP/bea /products/ bea_ summary.pdf (accessed Novermber 17, 2007).

> accountability, and decision making throughout the Department for effective and efficient delivery of warfighter capabilities. Acquisition Visibility brings transparency to critical information supporting full lifecycle management of the Department's processes that deliver weapon systems and automated information systems. This goal fully supports the responsibilities, scope, objectives, and business transformation requirements of the Weapons Systems Lifecycle Management (WSLM) CBM.[55]

A gap addressed in AV is the establishment of a SAR and PB Reconciliation Task Force that will study and provide recommendation for resolving discrepancies between data reported in SARs and the data provided in the PB FYDP. In October 30-31, 2007 at a Defense Acquisition Management Information Retrieval (DAMIR) conference presentation, Gary Bliss, from the ARA, O/USD AT&L, presented a task force update where he provided multiple case studies in which the differences in SAR and PB reported data raised the issue that the DoD Financial System is flawed.[56]

Table 26. Program Funding Status Summary (Dollars in Millions)

Fiscal Year	Report Date	RDT&E	APN	SAR	Reconcile Differences
2000	Feb-99	629.72	2,929.99	3,643.70	83.99
2001	Feb-00	676.70	2,937.25	3,731.00	117.05
2002	Jun-01	763.84		3,710.90	
2003	Feb-02	1,135.82	5,109.94	6,234.60	-11.16
2004	Feb-03	1,171.31	5,560.79	6,721.20	-10.91
2005	Feb-04	1,195.65	5,642.03	6,827.30	-10.38
2006	Feb-05	1,324.85	6,676.11	8,004.50	3.55
2007	Feb-06	1,321.96	6,636.94	8,015.30	56.40
2008	Feb-07	1,346.10	7,360.36	8,706.50	0.04

Because reported SAR Program Funding Data, Table 21, do not fall in line with the PB, the closest SAR funding data submission was utilized for reconciliation. In most cases, this was the previous December SAR data submissions. The largest reconciled difference is seen during FY 2007. While $56.4 Million is not a small sum by any

[55] Business Transformation Agency Acquisition Visibility website definitions and goals, http://www.defenselink.mil/DBT/ products/2007_BEA_ETP/etp/AV-Chart.html.

[56] Gary Bliss, "SAR to President's Budget (PB) Reconciliation Task Force Update," October 30 and 31, 2007, slide 6, https://acc.dau.mil/CommunityBrowser.aspx?id=180027&lang=en-US.

means, this amount made up less than 1% of the record total program procurement cost. Meaning, less than 1% of the content difference was unaccounted for between the FY2007 PB (RDT&E and APN) and SAR December 2005. The FY2008 PB successfully reconciled with the SAR December 2006 submission.

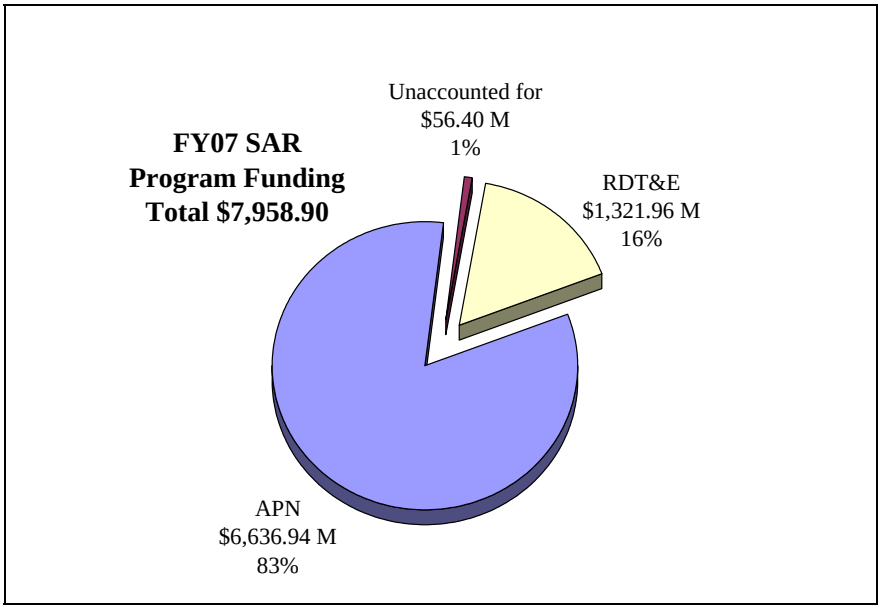

Figure 8. FY07 H-1 Upgrade Program SAR/PB Reconciliation

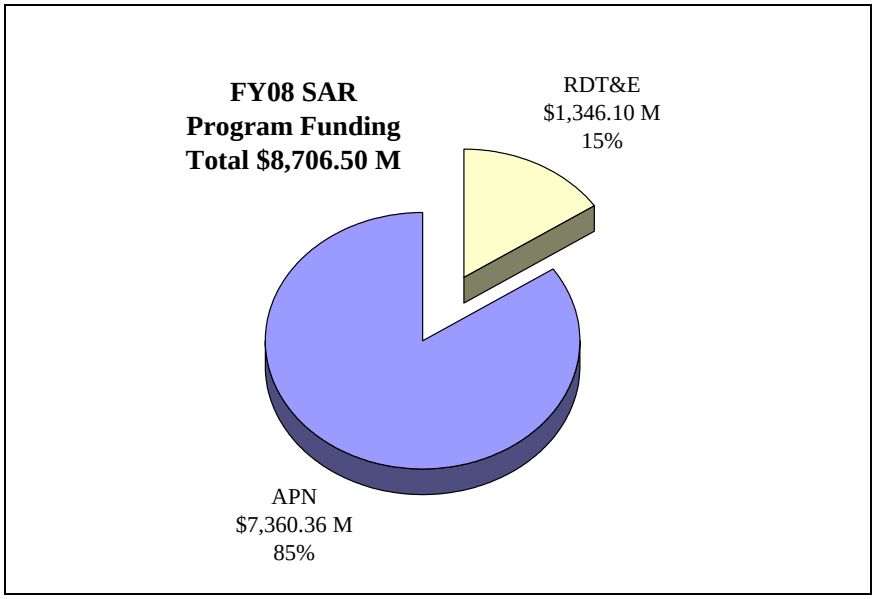

Figure 9. FY08 H-1 Upgrade Program SAR/PB Reconciliation

Recommendations provide by the task force to improve the reconciliation process were[57]:

- DAMIR/SAR Deltas
  - Expand SAR Format "Track To Budget" to cover all PEs referenced to the Program
  - Expand SAR "Funding Annual Summary" Tables to include PB totals by PE per Fiscal Year
- Perform SAR/PB Reconciliation In Fall
  - Use current PB submission to last SAR to obtain Program deltas
  - Findings show the big value SAR –PB disconnects are visible

Figure 10 graphs all nine years side-by-side. The APN data reported in FYs 2000 and 2001 was taken from the RDT&E item justification report and the lack of initial spares data may account for the 2-3% content differences. Data reported for FY2002 on June 2001 was incomplete for APN and cost accounting data and, therefore, could not be utilized in reconciliation.

[57] Gary Bliss, "SAR to President's Budget (PB) Reconciliation Task Force Update," October 30 and 31, 2007, slide 7, https://acc.dau.mil/CommunityBrowser.aspx?id=180027&lang=en-US.

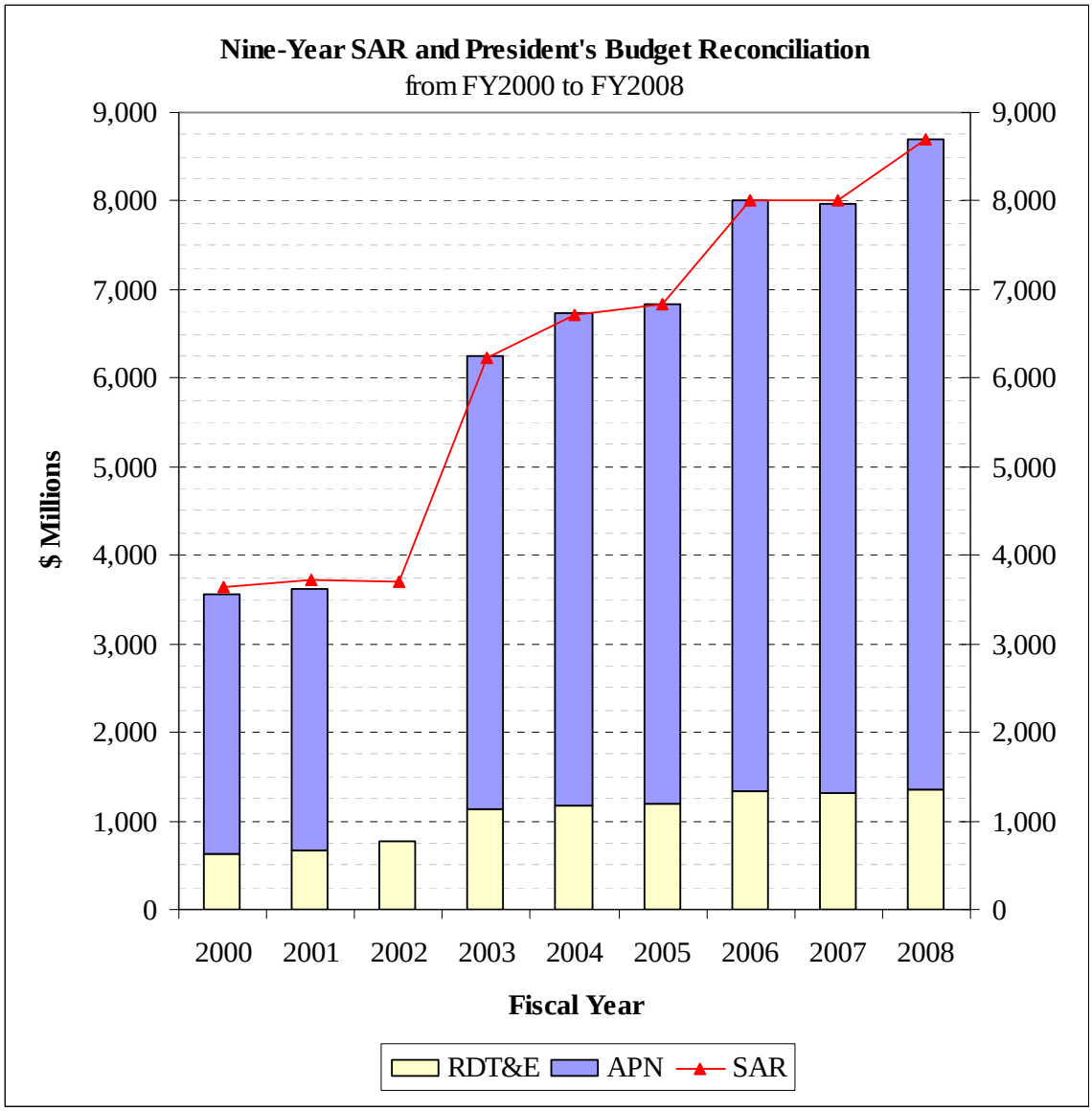

Figure 10. Nine-Year SAR and President's Budget Reconciliation from FY 2000 to 2008

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V. CONCLUSION

A. ANSWERS TO RESEARCH QUESTIONS

1. Primary Question

How have the H-1 Upgrade Program costs increases changed since the 2001-2002 Nunn-McCurdy Breach?

2. Secondary Questions

a. What are the background and history of the H-1 helicopter and H-1 Upgrade Program?

b. How does recent acquisition reform of the Nunn-McCurdy Thresholds affected the H-1 Upgrade Program?

c. How do the cost variance categories contribute independently and collectively to the overall program cost increases during the EMD/SDD Phase?

d. Has the H-1 Upgrade Program cost increases stabilized?

e. Do program Selected Acquisition Reported Data and the President's Budgeted Data reconcile?

The overview of the H-1 helicopter mission need, history, operational requirements, technical characteristics, contractual developments and adjustments provided the necessary background and historical record to satisfy question 2(a).

Under the initial Nunn-McCurdy threshold regulations 15/25, it seemed that a program could re-baseline prior to reporting large cost increases, thus, aiding in the masking of true cost growth. This ambiguity was tackled in the FY 2006 NDAA cost threshold adjustments. The new cost thresholds broke down into two categories: one for

those programs that have re-baselined their initial estimates and another for those programs who continue to utilize their original baseline estimate. The H-1 Program did have one critical breach and two significant increases but never re-baselined. The program continues to utilize the 1996 base year cost estimates when calculating and reporting SAR data.

At first glance, the cost increase experienced in December 2006 of 17.1 percent BY$ might raise a few eyebrows in the Congressional arena, but under the new thresholds the H-1 Upgrade Program does not require Congressional notification. If the new thresholds 30/50 for original Baseline Estimates had been established in 2002, the upgrade program would not have had two additional significant threshold breaches after the critical breach in December 2001.

Prior to the critical breach, the engineering cost variance accounted for more than 72% of the total cost increases recorded by the program. These changes represent the development of the system or items delivered. Schedule cost variances that affect delivery, procurement, and milestones had no influence on cost increase. The remaining 28% of the average total cost increase split between the supporting requirements and estimations due to correction of error in preparation of the prior cost estimate. Toward the end of 2000, supporting requirements began to account for a larger share of the two variances. After the critical breach, more than 63% of the total cost increases were attributed to estimating changes. Engineering and support variances attributed approximately 14 and 20 percent of the cost variances, respectively. However, engineering cost variances percentages were lower after the breach they did not decrease and were only offset by the large estimation variance increase. After the critical breach, scheduling cost variances began to have an effect on approximately 3% of the total costs. It is hard to believe that ‘Other’ cost increases due to the many natural disasters or unforeseeable events during the last 10 years, like the war in Iraqi, Hurricane Katrina and 9/11, did not have an effected on the cost increases over the time.

B. CLOSING

In 1996, the H-1 Upgrade Program began its journey through the infamous DOD acquisition process. Ten years later, the H-1 Program Manager stated that deliveries to government test squadrons would begin in November 2006 followed by training squadron insertion at HMT-303 in February 2007 and the first Fleet Marine Corps squadron detachment would begin training in January 2008 to meet the initial operational capability milestone by September 2008.[58] As a Marine Corps Aircraft Maintenance Officer who's career began in the H-1 arena, this writer can only preface all comments or opinions about the upgrade program as definitely bias; having experienced first hand the problems associated with aging airframes, the lack of supply support available, and the positive impact that these aircraft bring to any mission or rescue. Based on the data, presented in the reports, by the PM and publically accessible, this program could have been managed better prior to December 2001, or at the very least, provided better cost estimates. We are taught that bad news does not get sweeter with age, and therefore, if cost estimates had been shown to increase gradually, rather than the overnight increase, a Congressional review may not have been necessary. Cost increases occur and not tracking these properly only compounds the issue. The value this program brings to Navy and Marine Corps readiness and mission success is no doubt an underlining factor for having successfully acquired recertification in 2002.

Over the past six years, the cost increases experienced by the H-1 Program have averaged 19 percent, well below the new 30/50 threshold requirements for programs of original Baseline Estimates. The historical look at the Nunn-McCurdy inception, threshold modifications, affects of the threshold modifications on the cost breach of 2001 and cost variance growths provided an insight to the overall cost improvements of H-1 Program. This project established program stability in cost increases within the System Development and Demonstration Phase of the Marine Corps H-1 Upgrade Program were stability means staying below the significant reporting threshold limit of 30% defined under the new threshold limitations. One could make a valid argument that all our

[58] Defense Daily (2006), "Navy Awards Bell $137 Million Contract For First Seven UH-1Y Helicopters," Potomac: Jul 25, 2006. Vol. 231, Issue 14, p. 1.

defense programs should strive for cost increases closer to that of a national inflation rate; yet, programs do not perform in a single variable milieu. The System Management Framework includes multiple variables from the environment (industry, congressional, public), inputs (socio-economic, resources, end-users), conversions (JCIDS, PPBE, FAR), output (weapon, security, and defense) and feedback (GAO, IG, reform). Each of these variables can effect the cost of a program independently and as a group they begin to increase the overall cost potential of a program linearly or even exponentially.

C. RECOMMENDATIONS FOR FURTHER RESEARCH

Over the course of this project a few areas of additional research surfaced that could either effect the overall conclusions of program stability or provide additional support and validate the necessity for the threshold changes.

- A comparative analysis into the H-1 Upgrade Program's schedule delays and performance to the cost overruns would provide a more complete picture of the programs overall stability. Analysis of each area is beneficial in ferreting out selective trouble spots; to understand overall program improvement cost, schedule and performance could collective tell a different story of success or failure.
- In addition, investigation into how the new thresholds affected programs that have re-baselined and/or had quantity adjustments are additional areas of interest that surfaced during this project.

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