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**Cost-benefit Analysis of the Department of Navy's Transition
from C-9 Aircraft to C-40 Aircraft for Logistic Support
Operations**

15 December 2009

by

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LT Tony Wilborn, USN

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Abstract

The Navy began transitioning from the aging C-9s, which peaked at a total fleet size of 27 C-9B/DC-9 aircraft, to the C-40A. However, in response to increasing defense budget scrutiny and competing priorities, the Navy has decided to put this program on hold. Although the C-9B is an aging airframe and will require mandatory Federal Aviation Administration mandated modifications and upgrades, the DC-9/C-9B airframe has recently been determined to have significant operational service life remaining.

This project provides a Cost-benefit Analysis (CBA) of the changes associated with replacing the C-9B aircraft with the C-40A. We analyze three alternatives. The first assumes that the C-40A acquisition program will remain on-hold indefinitely. The second alternative foresees the C-40A acquisition resuming as currently projected in FY2015. The third alternative involves the original C-40A acquisition program as per *Naval Air Plan 2030 (NAP 2030)*. The objective is to compare the three alternatives, choosing the alternative, which provides the greatest net benefit and most efficient use of resources. The analysis will involve data collection of operational costs per flight hour, and total costs over the life of the program.

Our cost-benefit analysis is intended to indicate the best course of action to provide continued execution of the Navy's Unique Fleet Essential Aircraft (NUFEA) mission. We intend to document all costs incurred and potential savings from a transition to the C-40 aircraft. We find that Alternative Three has lower discounted costs, as well as lower risk and better capabilities, and therefore recommend the Navy transition back to the original C-40 program as soon as practical.

Keywords: aircrafts, Logistic Support Operations, NUFEA



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Disclaimer: The views represented in this report are those of the author and do not reflect the official policy position of the Navy, the Department of Defense, or the Federal Government.



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I. Introduction

Navy global logistics have become a priority to the Department of Defense (DoD), mainly due to changing operational requirements and the need for logistical support in multiple theaters. The logistics mission of the Navy has seen an increase in demand for logistic support aircraft. These Navy Unique, Fleet Essential Airlift (NUFEA) aircraft are assigned to Fleet Logistics Support Wing (FLSW), headquartered in Fort Worth, TX, and include C-130Ts, C-40As, C-9Bs, and C-20s. The Navy has relied on NUFEA aircraft to support the logistics requirements of the Fleet in steady state, surge, and wartime operations.

The Fleet Logistics Support Wing (FLSW) was established in 1974 to operate Navy Unique, Fleet Essential Airlift (NUFEA) on a worldwide basis to provide responsive, flexible, and rapidly deployable air logistics support. During peacetime, the squadrons provide air logistics support for all Navy commands, as well as continuous quality training for mobilization readiness. The Fleet Logistics Support Wing has no counterpart in the Regular Navy. It operates 100% of the Navy's medium and heavy intra-theater airlift, and provides the critical link between deployed sea-going units and air mobility command logistics hubs.

For over 30 years, these DC9/C-9B aircraft have been the primary fleet logistics support aircraft. Today, the DC/C-9B aircraft need costly upgrades to replace engines and avionics. In addition, new Navy operational needs and base closures have increased the required range of its logistics aircraft—to include nonstop flights from Hawaii to Japan and back to the United States. In addition, tougher noise controls at many locations in Europe and the United States have further limited the usefulness of the C-9 (Global Security, 2005).

The Navy needed a new aircraft to move its air logistics forward. The Naval Reserve contracted with Boeing for nine 737-700 aircraft, to be designated the C-



40A “Clipper.” The C-40A provides superior fuel efficiency, range and payload and meets or exceeds international environmental and noise restrictions (Military.com, n.d.).

The Navy began transitioning from the aging C-9s, which peaked at a total fleet size of 27 C-9B/DC-9 aircraft, to the C-40A. However in response to increasing defense budget scrutiny and competing priorities, the Navy has decided to put this program on hold. Although the C-9B is an aging airframe and will require mandatory Federal Aviation Administration-mandated modifications and upgrades, the DC-9/C-9B airframe has recently been determined to have significant operational service life remaining (NAVAIR , 2008, November). Our cost-benefit analysis is intended to indicate the best course of action to provide continued execution of the NUFEA mission. In this study, we intend to document all costs incurred and potential savings from a transition to the C-40 aircraft. We will analyze alternatives for continued operation of the C-9B aircraft (with required upgrades) and examine which features would complete the transition to the C-40A.



II. Background

A. Mission

NUFEA aircraft provide airlift assets/air transportation in support of naval operations' transportation requirements. This capability is intended to ensure the Navy's ability to respond to emergency and wartime requirements. NUFEA aircraft also provide Combatant Commanders with short-notice, quick-response, intra-theater logistics support via medium and heavy-lift capabilities. Airlift sorties consist of various passenger and cargo loads moved to sites dictated by fleet requirements (Commander, Naval Air Forces, 2008). Authorized by Title 10, *United States Code*, NUFEA aircraft support fleet movements that are not compatible with Air Mobility Command (AMC) Channel flights, AMC Special Assignment Airlift Mission (SAAM) flights, or commercial routes. In particular, NUFEA is designed to provide time-essential airlift support required to sustain combat operations at sea (Wirwille, Larson, & Kirk, 2005).

B. Aircraft

1. C-9B Skytrain

The C-9B Skytrain aircraft, which has been operational since 1968, is a modified McDonnell Douglas DC-9 aircraft with all-passenger, all-cargo, or a combination of passenger/cargo handling capabilities. This has afforded warfighters a great deal of flexibility and has supported a wide range of passenger and cargo mission requirements. As with other convertible passenger/cargo aircraft, the C-9Bs differ from standard airline aircraft in having a large cargo door on the left side of the forward fuselage, along with other necessary cargo-handling features.

More than five years prior to the Navy's acquisition of the C-9B, the Air Force selected the C-9A Nightingale Aero-medical airlift transport. The Navy selected a different name for its version to reflect the nature of naval-specific missions. The



Skytrain II name carries on the traditions of the famed DC-3 of WW II, the original Skytrain (Department of the Navy, Naval Historical Center, 2000). The C-9B *Skytrain* has served the fleet exceptionally well for years. But with the average age of these aircraft, now at 34 years, their maintenance costs are steadily rising.

2. C-40A Clipper

The C-40A Clipper is a Boeing 737 derivative that has been modified to provide Navy-unique worldwide airlift capability. This airframe design was chosen due to the success of Boeing 737's successful and highly reliable airframe, which has been in service since 1967 (Global Security, 2005). The C-40 consists of a Boeing 737-700C airframe with modified landing gear (for increased loads) and an added side cargo door. This modification enables the C-40A Clipper to operate in an all-passenger configuration (capacity of 121), an all-cargo configuration (capacity of 8 pallets totaling 40,000 pounds), or in a passenger-cargo combination with room for 70 passengers and three pallets of cargo. With combined passenger and cargo loads, the plane's cargo compartment can be sealed to isolate passengers and crew from any hazardous cargo that might be aboard. The C-40A also has redesigned wings that are stronger and use an advanced-technology airfoil that provides greater fuel efficiency in flight. This aircraft is also equipped with two General Electric CFM-56 engines that add to the fuel efficiency and are quiet.

The Clipper has a fully digital "glass" cockpit that is fitted with a heads-up display, allowing pilots to keep their eyes focused outside in low-visibility approaches. This display includes a flight management computer system with an integrated GPS as a valuable upgrade for approaches to airports with less-reliable ground systems. The glass cockpit also includes the Traffic Alert and Collision Avoidance System II, an enhanced ground proximity warning system, predictive wind shear indicator, and TACAN/UHF/IFF functions.



Table 1. Comparative Aircraft Performance Data
(United States Navy, 2009a; 2009b)

	C-9B	C-40A
Length	119 feet 3 inches	110 feet 4 inches
Height	27 feet 5 inches	41 feet 2 inches
Wingspan	93 feet 3 inches	117 feet 5 inches
Max Take-off Weight	110,000 lbs	171,000 lbs
Range (w/5000 lb payload)	2,475 nautical miles	3,680 nautical miles
Range (w/max payload)	1,447 nautical miles	3,000 nautical miles
Airspeed	565 mph	615 mph
Ceiling	37,000 feet	41,000 feet
Propulsion	(2) Pratt & Whitney JT8D-9A	(2) General Electric CFM56-7
Thrust (per engine)	14,500	24,000
Fuel Consumption (gal/FH)	893	747
Passengers	90	121



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III. Methodology

This section presents the methodology we used to perform a CBA for the Navy's transition from the C-9 to C-40, including data collection, applicable definitions, and assumptions. Our CBA process includes the following steps: (1) specify the set of alternative projects, (2) decide which benefits and costs matter, (3) catalogue the impacts and select measurement indicators, (4) predict the impacts quantitatively over the life of the project, (5) monetize (attach dollar values to) all impacts, (6) discount benefits and costs to obtain present values, (7) compute net present value of each alternative, (8) perform sensitivity analysis, and (9) make a recommendation based upon the net present value and sensitivity analysis (Boardman, Greenberg, Vining & Weimer, 2006).

We analyze three alternatives in this CBA. The first assumes that the C-40A acquisition program will remain on-hold indefinitely. The second alternative foresees the C-40A acquisition resuming as projected for FY2015 (Gorman, 2009). The third alternative involves the original C-40A acquisition program as per *Naval Air Plan 2030 (NAP 2030)*.

Several assumptions come to mind with regard to all three alternatives. The first of these assumptions is that contract-supported maintenance will continue as described in the current contract; second, that adequate competition for maintenance contracts will still exist, with future contract prices remaining about the same as the existing maintenance contracts; third, that analyzing the major cost components of operating and support costs—to include fuel and military personnel costs—is sufficient to estimate the cost per aircraft flying hour with adequate precision; fifth, that government-furnished infrastructure assets are common costs incurred by the maintenance activity selected, contractor or organic, per the specific T/M/S aircraft. (As such, we needn't include such costs explicitly in our analysis.) Finally, when calculating NPV, we will analyze 21 years worth of data for this CBA



(FY2010-2030) based on the comparison of costs associated with the current *Naval Air Plan 2030*. Assumptions specific to each alternative will follow.

A. Alternative One: "Frozen"

First, the C-9B retirement plan is still on hold, with the currently budgeted C-40A acquisition aircraft (numbers #10, #11, and #12) being delivered one each in FY2010 – FY2012. Second, four C-9B aircraft will be retired upon the acceptance of the three C-40A aircraft. Third, the maintenance cost for maintaining aging aircraft will continue to increase. Fourth, spare parts for the C-9B are available and will continue to be available in the current supply system. Fifth, all aircraft will be modified to meet FAA-mandated updates to the C-9B, to include Depot-level service-life extensions performed within the current SDLM induction schedule.

B. Alternative Two: "Delayed"

First, the C-9B retirement plan is still on hold, with the currently budgeted C-40A acquisition aircraft (numbers #10, #11, and #12) being delivered one each in FY2010 – FY2012. Second, four C-9B aircraft are retired upon the acceptance of the three C-40A aircraft. Third, the acquisition of C-40A aircraft would resume with the FY2015 budget, with the acquisition of one C-40A aircraft per year until a total of 17 C-40A aircraft are delivered. Fourth, C-9B aircraft would be retired on the same ratio per C-40A (4:3). Fifth, maintenance cost for maintaining aging C-9B aircraft will continue to increase. Sixth, spare parts for the C-9B will continue to be available in the current supply system. Finally, all aircraft will be modified to meet all FAA-mandated updates needed for the C-9B to include any necessary Depot-level service life extensions based on the current SDLM induction schedule.



C. Alternative Three: "Accelerated"

First, the C-9B retirement plan would be reinstituted as previously planned per NAP 2030. Second, the acquisition of one C-40A would continue each fiscal year as per NAP 2030. Third, contractor-performed maintenance will continue in accordance with current contract terms and requirements.



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IV. Identify Set of Alternatives

Step 1 of the CBA requires the analyst to identify the set of alternative projects to be analyzed (Boardman et al., 2006). The three alternatives presented above will be analyzed in this CBA.

A. Alternative One: "Frozen"

The first alternative analyzes the current state while remaining with the status quo. This analysis involves continuing to operate the 15 C-9B aircraft beyond its projected retirement date. Doing so requires that all C-9B aircraft be modified to meet all FAA-mandated updates.

Table 2. Alternative #1 Aircraft Assignment

	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21
C-9	15	15	11	11	11	11	11	11	11	11	11	11
C-40	10	11	12	12	12	12	12	12	12	12	12	12

B. Alternative Two: "Delayed"

The second alternative analyzes the future state of projected aircraft that have been previously purchased/budgeted but not yet delivered. This scenario involves retiring 4 C-9B aircraft upon receipt of an additional 3 C-40A aircraft, for a total of 11 C-9B and 12 C-40A aircraft.

Table 3. Alternative #2 Aircraft Assignment

	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21
C-9	15	15	11	11	11	8	8	4	4	0	0	0
C-40	10	11	12	12	12	12	12	13	14	15	16	17



C. Alternative Three: "Accelerated"

The third alternative analyzes the minimum replacement requirement of 17 C-40A aircraft as determined by a Center of Naval Analysis study (Roek & Abajian, 2008). This scenario involves retiring all 15 C-9B aircraft and acquiring 8 additional C-40A aircraft based on the *NAP 2030 schedule*.

Table 4. Alternative #3 Aircraft Assignment

	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21
C-9	13	8	8	4	4	0	0	0	0	0	0	0
C-40	10	11	12	13	14	15	16	17	17	17	17	17



V. Decide Which Benefits and Costs Count

Step 2 of a CBA requires the analyst to decide which alternatives are feasible, and which benefits and costs should be counted (Boardman et al., 2006). A stakeholder analysis is an effective way to accomplish this task. A stakeholder analysis is the initial step to building the relationships needed for the success of a participatory change, initiative, or policy. Such an analysis also aids in assessing the external environment in which the changes will take place. A given stakeholders' ability to influence the outcome of a decision depends on the position/assignment that stakeholder holds and whether or not he/she is a decision-maker, customer, or supplier. This analysis will, at a minimum, identify and define the characteristics of key stakeholders and assess the capacity of different stakeholders and stakeholder groups to participate in the decision-making process. Table 5 provides a summary of key stakeholders and their potential to influence the choice of alternatives analyzed in this CBA. Following the table, we discuss the reasoning behind these categorizations.

Table 5. Stakeholder Analysis

STAKEHOLDER	INFLUENCE ON ALTERNATIVES
Fleet Logistics Support Wing	Medium
CNAR	High
NAVAIR	High
Congress	High
Contractors	Low

The mission of Fleet Logistics Support Wing is to support the logistics requirements of the Fleet during major combat operations (MCO) and major mobilization of the Navy and Marine Corps such as Carrier Airwing (CVW) movements (Daly & Dettmer, 2007). The pilots assigned to the squadrons within the Fleet Logistics Support Wing are stakeholders, as they are operators of the subject



aircraft. The pilots provide an operational perception of the costs and benefits of C-9B and C-40A aircraft. As operators, they are not the primary decision-makers who will implement the recommendations of this CBA. However, as the primary operators, CFLSW pilots have the potential to moderately influence the choice of alternatives.

Commander, Naval Air Force Reserve (CNAFR) is the senior Type Command (TYCOM) for all reserve aviation assets used by the United States Navy. CNAFR provides operationally ready air squadrons to the fleet. The CNAFR office ensures that the reserve aviation fleet squadrons are trained and that their aircraft are ready for action, backed by a system of spare parts and maintenance support. As the TYCOM, CNAFR office is a stakeholder of the alternatives of this CBA. Many of the individuals within the CNAFR are former pilots who have flight experience and have assumed administrative and managerial duties for the TYCOM. They provide both an operational and administrative viewpoint of the costs and benefits of C-9B and C-40A aircraft. As administrators/managers, they are frequently involved in major decision-making processes. Thus CNAFR has the potential to significantly influence the choice of alternatives for this CBA.

The mission of Naval Air System Command (NAVAIR) is to develop, deliver, and sustain aircraft, weapons and systems on time and on cost with proven capability and reliability so Sailors and Marines can succeed in every mission and return home safely. NAVAIR provides unique engineering, development, testing, evaluation, in-service support, and program management capabilities to deliver airborne weapons systems that are technologically superior and readily available (NAVAIR, 2008, January 28). Using a full-spectrum approach, the command delivers optimal capability and reliability for the Sailor and the Marine. As the Naval Air Systems Command for the US Navy, NAVAIR is a stakeholder and a primary decision-maker for the Navy concerning Naval Aviation. Hence, NAVAIR has the potential to significantly influence the choice of alternatives of this CBA.



As it is composed of elected officials, Congress is a stakeholder of this CBA. Congress has the authority to authorize and appropriate funds as well as pass and enact legislation. Thus, Congress has the potential to significantly influence the choice of alternatives of this CBA.

Government contractors have a high interest in being awarded government contracts as they are motivated by profit. Thus, contractors are stakeholders in this CBA. The current C-9B and C-40A maintenance contracts had several responsive and responsible bidders. Market research by NAVAIR indicates that there will continue to be several responsible and responsive contractors to perform maintenance for either of the aircraft platforms when the existing contracts expire. Hence, in such a competitive buyer's market with multiple sellers all seeking contracts, any given seller will exert minimal influence over a buyer who has several sellers from whom to buy. Under these conditions, contractors have the potential to minimally influence the choice of alternatives in this CBA.



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VI. Catalogue of Impacts and Select Measurement Indicators

Step 3 of a CBA requires the analyst to catalogue the physical impacts of the alternatives as benefits or costs and then to select the units of measurement for each impact indicator (Boardman et al., 2006). Table 6 summarizes the impacts and measurement indicators for each of the three alternatives analyzed for this CBA.

Table 6. Impacts and Units of Measurement Indicators

Impacts and Measurement Indicators	C-9B	C-40A	Units of Measurement
COSTS			
Operation & Support	Operating & Support costs obtained from VAMOSC	Operating & Support costs obtained from VAMOSC	Dollars
Fuel	Fuel costs obtained from VAMOSC	Fuel costs obtained from VAMOSC	Dollars
MILPERS	MILPERS costs obtained from VAMOSC	MILPERS costs obtained from VAMOSC	Dollars
C-9B Modifications & Upgrades	Modification costs obtained from NAVAIR PMA-207	Modification costs obtained from NAVAIR PMA-207	Dollars
C-40A Acquisition	Not Applicable	Acquisition cost per FY2010 Budget Proposal	Dollars
BENEFITS			
Safety	Hazard Report data obtained from Naval Safety Center	Hazard Report data obtained from Naval Safety Center	Hazards avoided converted to dollars
Readiness	Aging aircraft scenario to include spare part availability	Non-aging aircraft and dedicated parts availability	Qualitative Impact



Recognizing the changing global demand for Navy organic airlift, the Department of the Navy (DON) and Maintenance (Active) and Operations and Maintenance (O&M) (Reserve) appropriations include billions of dollars each fiscal year for the Flying Hour Program (FHP). Increasing operating costs are testing the Navy's ability to achieve readiness goals. Therefore, this analysis must provide a brief overview of the Navy's FHP and direct flight-hour cost elements captured in the Visibility and Management of Operating and Support Cost (VAMOSOC) management information system, as we used this system for the cost data in this CBA.

The Assistant Chief of Naval Operations (CNO) for Air Warfare (N-78) is responsible for determining the funding required for each aircraft type/model/series (T/M/S). However, in an effort to improve matching budgeted funding levels with execution requirements, the Office of the Chief of Naval Operations (OPNAV) implemented a number of key enhancements. Specifically, OPNAV made changes to existing pricing models used in the formulation of OP-20 funding levels. These changes surfaced primarily due to two factors: transformational initiatives mandated by the Secretary of Defense, and the Navy's recently mandated adjustment to its readiness posture, which resulted in a fundamental shift in the operational execution and funding of Naval Aviation requirements.

Historic budget shortfalls have required the Navy to use creative cash management practices to support operations adequately. The N-78 staff members work closely with their counterparts at the major claimant level and with the Air Type Commander (TYCOM) to monitor flight hours flown. The TYCOM then distributes quarterly grants to each squadron under its command. Monthly feedback from the squadrons is gathered, analyzed, and relayed up the chain of command to track costs for fuel, contracts, and maintenance are tracking relative to the OP-20. Once TYCOM certifies the obligation, and the numbers are used to "cost out" the year's requirements for the fiscal year. Important data points such as aging aircraft, inflation factors, and other program change factors are also used to justify future



annual funding requirements. The Navy Aviation Enterprise is programmed, budgeted, and funded to fly roughly 1.5 million hours each year. The FHP provides resources for the Navy and Marine aviation team to train for readiness and to conduct warfare support operations.

This CBA will focus on the following key budgetary cost elements: Operating & Support Costs, Fuel, and all associated costs dealing with all Military Personnel (MILPERS).

A. Operating and Support

The Visibility and Management of Operating and Support Cost (VAMOSC) management information system collects and reports US Navy and US Marine Corps data that provide Operating and Support (O&S) flying hour costs for the FHP. The ability to estimate the costs of O & S activities has become increasingly important in recent years due to shrinking budgets, aging aircraft, and the cost of maintaining newer, more technologically advanced weapon systems. The objectives of the VAMOSC system are to provide visibility of O & S costs for use in cost analysis of the C-9B, C-40A and force-structure alternatives in support of the Programming, Planning, and Budgeting System (PPBS) process. The VAMOSC program was used to obtain actual annual costs incurred, given the number of flight hours by the C-9B and C-40A aircraft types. Flying hours are the basic element for measuring aircraft use. The researchers used Navy aircraft, flight hours, and costs to make comparisons between aircraft platforms for this CBA.

It is important to note, however, that both Fuel and MILPERS are components contained within the total Operating & Support Costs acquired from the VAMOSC system. We will, however, analyze each one independently in this CBA. Therefore, throughout this CBA, any reference to Operating & Support costs will refer to all costs per aircraft, minus those costs associated with both Fuel and MILPERS.



B. Fuel

Fuel usage for the Department of the Navy is charged at a price established by the Defense Energy Supply Center with the Naval Operational Logistics Support Center promulgating the expenditure price for all Navy and Marine Corps activities that report fuel usage each fiscal year. The researchers extracted actual costs incurred for fuel by both aircraft types from the VAMOSC system for comparative analysis.

C. MILPERS

The actual costs incurred for all MILPERS-associated costs were extracted from the VAMOSC system to adequately compare the differences in Manpower costs between each aircraft type.

1. Manpower Requirements

The Navy Manpower Analysis Center (NAVMAC) is responsible for determining and validating workforce requirements for fleet squadrons. NAVMAC establishes these requirements after carefully analyzing several critical components, including assigned mission, projected operational work environment, crew/seat ratio, and historical maintenance man-hours achieved per each T/M/S of assigned aircraft. A comparison of the requirements for both aircraft is beneficial as we compare the MILPERS-associated costs for each. We accessed the total requirements for each aircraft through the Squadron Manpower Documents (SQMD) “Class” records for both the C-9B and the C-40A. We have incorporated this data into Table 7 for comparison purposes.



Table 7. Squadron Manpower Requirements Comparison

	O-5	O-4	O-3	CWO	E-9	E-8	E-7	E-6	E-5	E-4	E-3		
C-40A	3	3	44	1	2	9	28	48	83	89	36	Total	346
C-9B	2	5	44	1	2	6	18	47	92	112	45	Total	374

It is important to note the reduction of 28 billet requirements in the C-40A Squadron Manpower document compared to those of the C-9B Squadron Manpower Document. This manpower reduction alone creates significant cost savings for the C-40A squadrons.

2. C-40 FM² (Flexible Maintenance/Manpower) Beta Test

Fleet Logistics Support Wing (FLSW) has also instituted a beta test at one of its squadrons (VR-58) for a “Flexible” Maintenance construct that features a combination of both military maintenance personnel and contracted maintenance personnel. In this test, FLSW has transitioned 17 military billets to contractor personnel, while it has deducted an additional 19 billets from its total requirements. Due to the nature of the beta test (and not because this is the norm for all of the C-40A squadrons), the savings recognized from this FM² concept will not be analyzed further in this CBA (but the savings are important to note for future considerations).

D. C-9B Modifications/Upgrades

As stated earlier, the C-9B has service life remaining—assuming all aspects of service, repair, and parts availability are maintained. This assumption depends upon the completion of the following modifications/upgrades: interior upgrades, engine hush kits, and wiring modifications. In addition, the following upgrades are needed to bring the C-9B’s into compliance with all FAA regulations:



1. CNS/ATM

CNS/ATM stands for Communications, Navigation Surveillance Systems/Air Traffic Management system. This a cockpit upgrade that uses the latest digital technologies, including satellite systems, and varying levels of automation to meet current FAA navigation requirements.

2. SFAR 88

The Special Federal Aviation Requirement (SFAR) No. 88 Fuel Tank System Fault Tolerance Evaluation Requirements is a Federal Aviation Administration (FAA)-mandated safety inspection of the airplane fuel tank system in an effort to eliminate potential fuel-system ignition sources.

3. FAA SB 5021

The Federal Aviation Administration Service Bulletin No. 5021 involves an engine modification needed to prevent the C-9B's engines from reaching high Exhaust Gas Temperature (EGT) overtemp conditions. These overtemp conditions have been a long-standing problem with the C-9B's engines when operating in hot climates, thus requiring extensive troubleshooting and repair. This modification prevents engines from reaching high EGT, therefore making them more reliable. This modification was funded at a price of \$4.1 million (NAVAIR, 2007) between 2007-2009. The SB5021 modification will not be analyzed for FY2007-2009.

4. ETOPS

Extended-range, Twin-engine Operations (ETOPS) is an FAA approval rating based on engine reliability. It provides airlines with greater route-scheduling flexibility by including longer over-water flights. Without an ETOPS rating, an aircraft with only two engines must be able to get to an airport where it can safely land within 60 minutes if an engine fails in-flight. ETOPS extends this window to 90 minutes or more, up to a maximum of 180 minutes. The C-40A has an ETOPS



rating of 180 minutes; the C-9B is not ETOPS approved and, therefore, falls under the 60-minute base requirement. This modification is a future upgrade that needs to be addressed if C-9B continues in operation. The projected costs of these modifications are expected to be approximately \$425 million (NAVAIR, 2007), but it is important to mention that the ETOPS modification has not been approved or funded by the Department of the Navy. Therefore, though it is important to note for background purposes, it will not be analyzed within this CBA.

E. Acquisition

The procurement cost of \$74.38 million, acquired from the Department of the Navy's *FY 2010 President's Budget*, was the baseline for all C-40 aircraft acquisition costs per aircraft analyzed in this CBA.

F. Safety

A safety benefit would exist if hazard rates varied between the two aircraft. Aviation safety data for both the C-9B and C-40A was retrieved from the Naval Safety Center Aviation Data and Analysis Division. The C-9B safety data spanned the period from 1981 through the end of 2009. We collected the C-40A aviation safety data from 2001 through 2009. We evaluated the aviation safety data by classifying severe hazards (in which loss of life or serious hazard was likely or probable) and routine hazards (in which minor injury was likely or probable). The C-9B had 361 severe hazards and 379 routine hazards, whereas the C-40A had 28 severe hazards and 53 routine hazards.

In order to determine a hazard-per-aircraft number, we divided each class of hazard by the number of aircraft in the US Naval Inventory for which the hazard occurred. The hazard-per-aircraft number, divided by the number of years for which the data was collected, provided a hazard-per-aircraft-per-year ratio. The difference in ratios for each aircraft suggests a safety benefit value for the aircraft that provided the fewer numbers of hazards. The C-40A had a lower ratio in the Severe Hazard



category, and the C-9B had a lower ratio in the Routine Hazard category. The severe hazard rate is .775 per year for the C-9B and .443 per year for the C-40A. The routine hazard rate is .819 per year for the C-9B and .843 per year for the C-40A. The C-40A has the lower severe hazard rate and will benefit with a .332 per year severe hazard benefit over the C-9B. The C-9B has the lower routine hazard rate and will benefit with a .024 routine hazard benefit over the C-40A. This means the C-40A has a 33.2% less likely chance of experiencing a severe hazard per year compared to the C-9B, and the C-9B has a 2.4% less likely chance of experiencing a routine hazard per year compared to the C-40A.

G. Readiness

Currently, the C-9B enjoys a dedicated parts/supply system; however, due to aging airframes and increased operating costs, an increasing number of civilian operators of the DC-9/C-9B are retiring their airframes. The continued departure of these operators will constrict the parts availability for the C-9B (due to parts attrition) and will increase the likelihood that current parts manufacturers will discard the DC-9/C-9B business for a more lucrative parts-support market. Decreased parts availability will have a direct impact on C-9B readiness. Readiness is a qualitative impact factor that does not have any quantitative measurement indicators; therefore, it will not be addressed again until the concluding section of this study.



VII. Predict Impacts Quantitatively Over Life of Project

Step 4 of a CBA is to quantify impacts that can be reasonably measured for each alternative over the life of the project (Boardman et al., 2006). The Operating and Support Costs, Fuel, and MILPERS are measured in dollars, so we will discuss their future budget impacts in the monetized impacts section. The benefits of safety are not measured in dollars, however, our calculations of the safety benefits per year in monetized units will be presented in the monetized impact section. Neither T/M/S reduction nor readiness benefits have any measurement indicators. Thus, these elements will not be addressed again until the recommendation section of this analysis.



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VIII. Monetized Impacts

Step 5 of a CBA is to monetize each of the impacts identified in Step 3 (Boardman et al., 2006). The impacts that are to be monetized include operation and support costs, fuel costs, military personnel costs, modification/upgrade costs, acquisition costs, and safety benefits.

The VAMOSC system provides Operating and Support (O&S) costs for naval aviation from high-level aggregate reports to detailed reports on individual systems during specific time periods. We used this data to obtain actual annual costs incurred given the number of flight hours by both aircraft types during FY08. A VAMOSC extract of the flying-hour program's direct costs are included in Appendix B. For the purpose of this CBA, we used Navy aircraft flight hours and costs to make comparisons between platforms. The annual O&S costs for both the C-9B and the C-40A programs are listed in Table 8. Recall that when the term Operating and Support is used, it refers to non-fuel, non-personnel O&S costs.

Table 8. FY08 Annual Operating Costs for C-9B & C-40A

CATEGORY	FY08 COSTS
C-9B	
Operating & Support	\$36,460,767
Fuel (FF)	\$30,059,738
MILPERS	\$48,652,828
Annual Costs	\$115,173,333
C-40A	
Operating & Support	\$29,068,556
Fuel (FF)	\$21,586,420
MILPERS	\$38,994,415
Annual Costs	\$89,649,391



We used these total costs for the C-9B and the C-40A programs to calculate cost per flying hour. The operational flight costs per flight hour for each aircraft are listed in Table 9.

Table 9. Comparison of Costs per Flight Hour for FY08

CATEGORY	FY08 COSTS
C-9B	
O&S costs per FH	\$2,351
Fuel costs per FH	\$1,938
MILPERS costs per FH	\$3,137
Total C-9B Cost/FH	\$7,426
C-40A	
O&S costs per FH	\$2,308
Fuel costs per FH	\$1,714
MILPERS costs per FH	\$3,096
Total C-40A Cost/FH	\$7,118

We entered the three major costs for the C-9B and C-40A models (Operating & Support, Fuel, and MILPERS) into Excel. We then divided each cost by the number of flight hours flown by each type of aircraft to determine the Operating & Support cost per flight hour, Fuel cost per flight hour, and MILPERS Cost per flight hour.



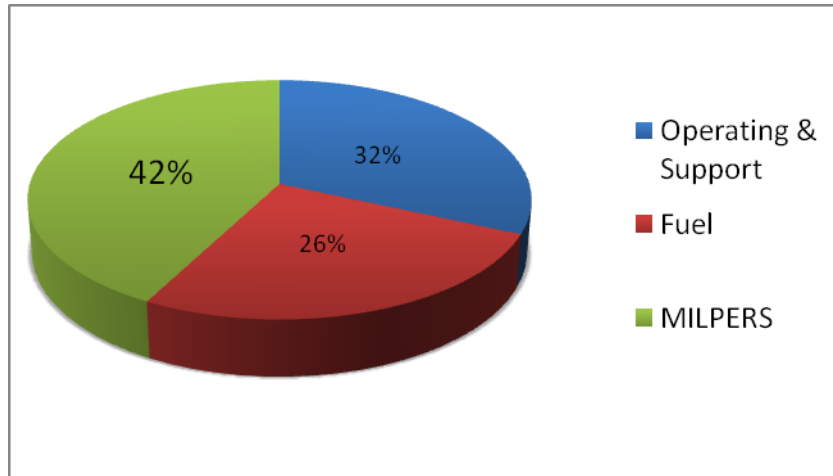


Figure 1. C-9B Flying Hour Cost Elements (2008)

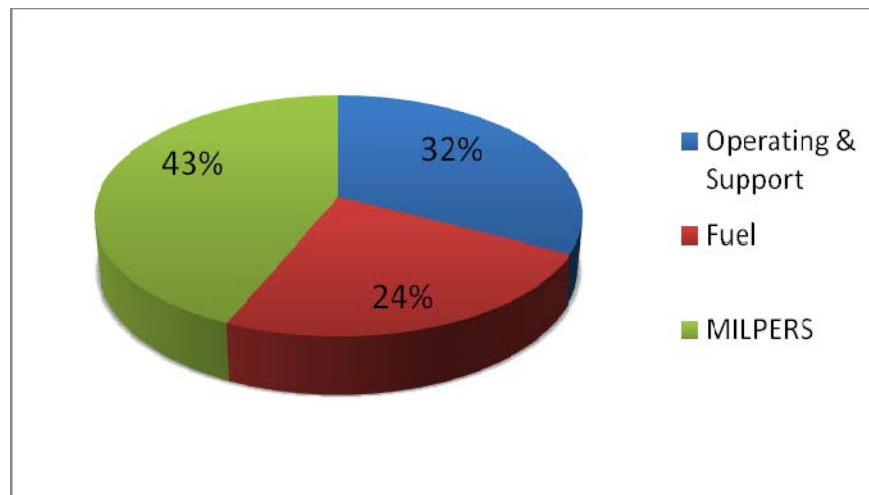


Figure 2. C-40A Flying Hour Cost Elements (2008)



A. Operating and Support Costs

We obtained Operating and Support costs for each type of aircraft from VAMOSC reports. We then extracted the associated fuel and MILPERS costs from the Operating & Support Costs to analyze each separately in this CBA. All remaining Operating and Support costs for this CBA include, but are not limited to the following: Aircraft Parts/Supplies, Maintenance Consumables, Contract Maintenance, Commercial Aircraft Rework, and Commercial Aircraft Engine Rework. We divided these costs by the number of flight hours to estimate an Operating and Support cost per flight hour. The costs we used for the future expenditures calculations in this CBA consisted of a trend-line forecast calculated based on the historical rising costs extracted from the VAMOSC system, due to the known Aging Aircraft scenario of the C-9B. We used the FY 2008 Operating and Support costs for the C-40A for the future expenditure calculations, as this aircraft does not fit the known aging aircraft scenario.

B. Fuel Costs

As mentioned above, fuel usage for the Department of the Navy is charged at a price established by the Defense Energy Supply Center. The Naval Operational Logistics Support Center promulgates the expenditure price for all Navy and Marine Corps activities to report fuel usage each fiscal year. The actual costs incurred for fuel by both aircraft types were extracted from the VAMOSC system and divided by the flight hours flown to determine a fuel-cost-per-flight-hour. Due to the fluctuating price of fuel, we used a three-year average for each T/M/S for the future-costs-expenditure calculations in this CBA.

C. MILPERS Costs

As explained above, we extracted the actual costs incurred for all associated MILPERS costs for both aircraft types from the VAMOSC system and divided these numbers by the flight hours flown to determine a fuel cost per flight hour. The



FY2008 MILPERS costs for each T/M/S were used for the future costs expenditures calculations in this CBA.

D. C-9B MODIFICATION/UPGRADES COSTS

We acquired the actual and projected costs for all approved C-9B modifications from NAVAIR PMA-207. We calculated the associated costs for modification on a “per aircraft” basis, converted them to FY2010 dollars, then applied this calculation across all alternatives based on the projected assigned C-9B aircraft for the year 2010. We then distributed the cost per alternative equally over a 4-year period in which modifications would be accomplished. The costs associated with each modification on a per-aircraft basis are included in Table 10.

Table 10. C-9B Modification Costs (FY2010 dollars)

CNS/ATM	\$6,062,595
Engine Hush Kits	\$5,249,000
Interior	\$1,283,986
Wiring	\$363,392
SFAR 88	\$74,104
Total per aircraft	\$13,033,077

E. C-40A Acquisition Costs

The C-40 Procurement Cost of \$74,381,000, acquired from the Department of the Navy’s FY 2010 President’s Budget was used as the baseline for all aircraft acquisition costs per aircraft analyzed in this CBA.



F. Safety Benefits

As explained above, the aviation safety data collected from the Naval Safety Center was categorized as either “severe hazards” or “routine hazards.” The C-40A has a 33.2% per year lower chance of experiencing a severe hazard, and the C-9B has a 2.4% per year lower chance for a routine hazard. We monetized safety benefits for both severe and routine hazards by applying each safety benefit against the amount of lost productivity time resulting from an average mishap. Damage to aircraft as a result of the hazard and the resulting repair costs will not be used, as these costs are captured in the direct costs of the flying-hour program. We will prorate the lost productivity using the wage rates for a Navy Third Class Petty Officer (E-4) with six years at an annual salary of \$46,430/yr (Fiscal year , 2009), since E-4s perform a majority of the maintenance work resulting from severe and routine hazards. The average number of lost productivity days for a severe hazard is 14 Days, while the loss for a routine hazard is 1 Day. Given a 360-day calendar year, lost productivity for an E-4 with six years is \$1,805.61 for a severe hazard and \$128.97 for a routine hazard. By applying both the C-40A safety benefits for severe hazard of 33.4% and the C-9B routine safety benefit of 2.4% per year, we calculate a monetized dollar figure of \$603.07 per year for severe hazards and \$3.10 per year for routine hazards. This data provides a net total dollar figure of \$599.88 per year benefit for the C-40A based on the current assignment of 9 aircraft. To evaluate the benefit of each alternative, we will use the value of \$66.66 per aircraft.



IX. Discounting Benefits/Costs to Obtain Present Value

Step 6 of a CBA requires the analyst to discount all benefits and costs to obtain present values of the three alternatives analyzed (Boardman et al., 2006). In accordance with Office of Management and Budget *Circular on Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, a discount rate of 7% will be used to account for the time-value of money (OMB, 1992). Because OMB A-94 states that future inflation is highly uncertain and that analysts should avoid making assumptions about inflation whenever possible, no provision is made in this study to account for inflation. We completed all computations using Microsoft Office Excel. We analyzed 21 years' worth of data (FY2010-2030) when calculating NPV. We chose this number based on the projected time period for acquisition of 17 C-40A aircraft upon resumption of the acquisition plan to future budgets starting in FY2015. The safety benefits for operating a C-40A in each plan are displayed in Table 11.

Table 11. Discounted Benefit of C-40A Safety History

YEAR	ALTERNATIVE ONE	ALTERNATIVE TWO	ALTERNATIVE THREE
2010	\$666.64	\$666.64	\$666.64
2011	\$733.31	\$733.31	\$733.31
2012	\$799.97	\$799.97	\$799.97
2013	\$799.97	\$799.97	\$866.64
2014	\$799.97	\$799.97	\$933.30
2015	\$799.97	\$799.97	\$999.96
2016	\$799.97	\$799.97	\$1,066.63
2017	\$799.97	\$866.64	\$1,133.29
2018	\$799.97	\$933.30	\$1,133.29
2019	\$799.97	\$999.96	\$1,133.29



2020	\$799.97	\$1,066.63	\$1,133.29
2021	\$799.97	\$1,133.29	\$1,133.29
2022	\$799.97	\$1,133.29	\$1,133.29
2023	\$799.97	\$1,133.29	\$1,133.29
2024	\$799.97	\$1,133.29	\$1,133.29
2025	\$799.97	\$1,133.29	\$1,133.29
2026	\$799.97	\$1,133.29	\$1,133.29
2027	\$799.97	\$1,133.29	\$1,133.29
2028	\$799.97	\$1,133.29	\$1,133.29
2029	\$799.97	\$1,133.29	\$1,133.29
2030	\$799.97	\$1,133.29	\$1,133.29
CUMULATIVE TOTAL	\$16,599.41	\$20,599.27	\$21,932.56
NPV @ 7%	\$8,485.28	\$9,937.20	\$10,745.87

The costs associated with each alternative are Operating & Support, Fuel, MILPERS, Modifications/Upgrades and Acquisition. Alternative One includes the costs of continuing to operate 15 C-9B and acquiring one C-40A aircraft per year until FY2012, at which time the Navy will retire 4 C-9B aircraft. However, the assignment of 11 C-9B and 12 C-40A will remain until 2030. The detailed costs for Alternative One are displayed in Table 12.



Table 12. NPV Alternative One

YEAR	O & S	FUEL	MILPERS	MODIFICATION & UPGRADES	ACQUISITION	YEARLY TOTAL
2010	\$63,104,441	\$54,849,638	\$91,979,956	\$48,874,039	\$74,381,000	\$341,577,753
2011	\$67,140,325	\$57,304,824	\$96,312,669	\$48,874,039	\$-	\$278,020,537
2012	\$62,531,374	\$51,680,605	\$87,671,294	\$48,874,039	\$-	\$259,145,992
2013	\$63,122,473	\$51,680,605	\$87,671,294	\$48,874,039	\$-	\$259,737,092
2014	\$63,713,573	\$51,680,605	\$87,671,294	\$-	\$-	\$203,065,472
2015	\$64,304,673	\$51,680,605	\$87,671,294	\$-	\$-	\$203,656,572
2016	\$64,895,772	\$51,680,605	\$87,671,294	\$-	\$-	\$204,247,672
2017	\$65,486,872	\$51,680,605	\$87,671,294	\$-	\$-	\$204,838,771
2018	\$66,077,972	\$51,680,605	\$87,671,294	\$-	\$-	\$205,429,871
2019	\$66,669,071	\$51,680,605	\$87,671,294	\$-	\$-	\$206,020,971
2020	\$67,260,171	\$51,680,605	\$87,671,294	\$-	\$-	\$206,612,070
2021	\$67,851,271	\$51,680,605	\$87,671,294	\$-	\$-	\$207,203,170
2022	\$68,442,370	\$51,680,605	\$87,671,294	\$-	\$-	\$207,794,270
2023	\$69,033,470	\$51,680,605	\$87,671,294	\$-	\$-	\$208,385,369
2024	\$69,624,570	\$51,680,605	\$87,671,294	\$-	\$-	\$208,976,469
2025	\$70,215,669	\$51,680,605	\$87,671,294	\$-	\$-	\$209,567,569
2026	\$70,806,769	\$51,680,605	\$87,671,294	\$-	\$-	\$210,158,668
2027	\$71,397,869	\$51,680,605	\$87,671,294	\$-	\$-	\$210,749,768
2028	\$71,988,968	\$51,680,605	\$87,671,294	\$-	\$-	\$211,340,868
2029	\$72,580,068	\$51,680,605	\$87,671,294	\$-	\$-	\$211,931,967
2030	\$73,171,168	\$51,680,605	\$87,671,294	\$-	\$-	\$212,523,067
CUM TOTAL	\$1,419,418,908	\$1,094,085,963	\$1,854,047,208	\$195,496,155	\$74,381,000	\$4,637,429,234

NET PRESENT VALUE @

7%= \$2,484,065,343

Alternative Two

involves retiring 4 C-9B

aircraft upon receipt of 3 additional C-40A aircraft (for a total of 11 C-9B and 12 C-40A aircraft in FY2012) then resuming acquisition of one C-40A per year starting with the FY2015 budget. The detailed costs for Alternative Two are displayed in Table 13.



Table 13. NPV Alternative Two

YEAR	O & S	FUEL	MILPERS	MODIFICATION & UPGRADES	ACQUISITION	YEARLY TOTAL
2010	\$63,104,441	\$54,849,638	\$91,979,956	\$48,874,039	\$74,381,000	\$341,577,753
2011	\$67,140,325	\$57,304,824	\$96,312,669	\$48,874,039	\$-	\$220,757,818
2012	\$62,531,374	\$51,680,605	\$87,671,294	\$48,874,039	\$-	\$201,883,273
2013	\$63,122,473	\$51,680,605	\$87,671,294	\$48,874,039	\$-	\$202,474,373
2014	\$63,713,573	\$51,680,605	\$87,671,294	\$-	\$-	\$203,065,472
2015	\$57,337,419	\$45,621,051	\$77,940,728	\$-	\$74,381,000	\$255,280,198
2016	\$57,767,309	\$45,621,051	\$77,940,728	\$-	\$74,381,000	\$255,710,089
2017	\$51,707,477	\$39,996,832	\$69,299,354	\$-	\$74,381,000	\$235,384,663
2018	\$55,152,262	\$42,452,019	\$73,632,066	\$-	\$74,381,000	\$245,617,347
2019	\$48,447,593	\$36,827,800	\$64,990,692	\$-	\$74,381,000	\$224,647,085
2020	\$51,677,433	\$39,282,987	\$69,323,404	\$-	\$-	\$160,283,824
2021	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2022	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2023	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2024	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2025	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2026	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2027	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2028	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2029	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2030	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
CUM TOTAL	\$1,190,774,403	\$934,379,752	\$1,620,994,651	\$195,496,155	\$446,286,000	\$4,387,930,960

NET PRESENT VALUE @
7%= \$ 2,446,689,702



Alternative Three involves retiring all 15 C-9B aircraft and acquiring 8 additional C-40A aircraft, for a total of 17 C-40A aircraft based on *Naval Aviation Plan 2030*. The detailed costs for Alternative 3 are listed in Table 14.

Table 14. NPV Alternative Three

YEAR	O & S	FUEL	MILPERS	MODIFICA- TION & UPGRADES	ACQUI- SION	YEARLY TOTAL
2010	\$58,996,968	\$50,809,935	\$85,492,912	\$42,357,500	\$74,381,000	\$315,242,135
2011	\$52,388,016	\$43,165,864	\$73,608,015	\$42,357,500	\$74,381,000	\$264,538,896
2012	\$56,047,747	\$45,621,051	\$77,940,728	\$42,357,500	\$74,381,000	\$299,236,906
2013	\$50,847,696	\$39,996,832	\$69,299,354	\$42,357,500	\$74,381,000	\$279,771,261
2014	\$54,292,480	\$42,452,019	\$73,632,066	\$-	\$74,381,000	\$244,757,566
2015	\$48,447,593	\$36,827,800	\$64,990,692	\$-	\$74,381,000	\$224,647,085
2016	\$51,677,433	\$39,282,987	\$69,323,404	\$-	\$-	\$160,283,824
2017	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2018	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2019	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2020	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2021	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2022	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2023	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2024	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2025	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2026	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2027	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2028	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2029	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
2030	\$54,907,272	\$41,738,173	\$73,656,117	\$-	\$-	\$170,301,563
CUM TOTAL	\$1,141,399,747	\$882,490,916	\$1,545,472,813	\$169,430,001	\$446,286,000	\$4,185,079,477

NET PRESENT VALUE @ 7%=
\$2,346,001,722



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X. Compute the Net Present Value (NPV) of Each Alternative

Step 7 of a CBA requires the analyst to compute the Net Present Value (NPV) of each alternative analyzed (Boardman et al., 2006). NPV is computed by taking the difference between the PV of benefits [PV (B)] and the PV of costs [PV (C)]. In this CBA, this equation is key to our recommendations and conclusions. According to Boardman et al. (2006), if there are multiple mutually exclusive alternatives, an analyst should pick the one with the highest NPV. A summary of each alternative is included in Table 15.

Table 15. Summary of Alternatives (7% Discount—Real Costs)

	BENEFITS [PV (B)]	COSTS [PV (C)]	NPV
ALTERNATIVE #1	\$8,485	(\$2,484,065,343)	(\$2,484,056,858)
ALTERNATIVE #2	\$9,937	(\$2,446,689,702)	(\$2,446,679,765)
ALTERNATIVE #3	\$10,746	(\$2,346,001,722)	(\$2,345,990,976)



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XI. Sensitivity Analysis

Step 8 of a CBA is to perform a sensitivity analysis of the alternatives under consideration. The purpose of sensitivity analysis is to acknowledge the underlying uncertainty associated with each assumption. In particular, it should convey how sensitive predicted net benefits are to changes in assumptions about the various alternatives (Boardman et al., 2006).

A. Treasury Bill Rate

In calculating the NPV for each alternative in the previous chapter, we used a discount rate of 7% to account for the time-value of money and the associated effects of inflation. Due to the nature of our analysis, we chose to use VAMOSC data in terms of constant FY 2010 dollars. “Constant” or “real” dollars are economic measurable units that relate to a constant purchasing power and are not affected by general price inflation. The *OMB A-94* indicates that a 2.9% rate is appropriate for “real” interest rates for a 20-year program. This 2.9% “real” interest rate is normally used for cost-effectiveness analysis and is adjusted to eliminate the effect of expected and/or actual inflation. This additional analysis is necessary to show the sensitivity that inflation has on these different alternatives. An additional summary of each alternative has been included in Table 16. Alternative Three still contains the highest NPV, being the negative number of smallest magnitude.¹ Moreover, the separation between the alternatives has grown significantly over the life of this program.

¹ Another way of saying the same thing is that Alternative Three is the minimum-cost course of action.



Table 16. Summary of Alternatives (2.9% Discount—Real Cost)

	BENEFITS [PV (B)]	COSTS [PV (C)]	NPV
ALTERNATIVE One	\$8,485	(\$3,487,991,920)	(\$3,487,983,435)
ALTERNATIVE Two	\$9,937	(\$3,362,342,929)	(\$3,362,332,992)
ALTERNATIVE Three	\$10,746	(\$3,210,459,856)	(\$3,210,449,110)

B. Non-Monetized Factors

1. Capability

The comparison between the two airframes must not be limited to O&S costs alone as these two airframes are not identical in capability. Therefore, the capability associated with each alternative should be addressed individually. The goal of the Department of the Navy is to eventually replace the original lot of 27 C-9B/DC-9 aircraft with the C-40A aircraft. The Center of Naval Analysis calculated an operational capability equivalency of 1.8 C-9Bs to 1.0 C-40A (Roek & Abajian, 2008). Table 17 illustrates the comparison of capability available per year for each alternative. It is understood that continuing to operate in the current assignment as per Alternative One would provide the greatest capability available; however, the focus of this comparison should be between Alternatives Two and Alternative Three as to what is the greater priority: average available capability throughout the program (Alternative Two) or achieving maximum capability as the earliest opportunity (Alternative Three).



Table 17. Capability Comparisons by Alternatives (in C-9B equivalencies)

	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	AVG
Alternative #1	33.0	34.8	32.6	32.6	32.6	32.6	32.6	32.6	32.6	32.6	32.6	32.6	32.8
Alternative #2	33.0	34.8	32.6	32.6	32.6	29.6	29.6	27.4	29.2	27.0	28.8	30.6	30.6
Alternative #3	31.0	27.8	29.6	27.4	29.2	27.0	28.8	30.6	30.6	30.6	30.6	30.6	29.5

2. Risk

Another non-monetized area of impact is associated with risk. As stated earlier, Boeing has been provided guidance that the C-B airframe has significant operational service life remaining (NAVAIR, 2008, November), however the decision-maker must consider the risk associated with continued use of such an aged aircraft. Parts will fail, and that percentage of failure only increases with age. Also, as we discussed earlier, the divestiture of other commercial airlines currently flying the C-9B will result in further reduction in parts availability. The decision-maker must weigh the age of parts, their availability, and the source from which they are acquired, as these metrics will directly affect the risk associated with continued operations of such an aged aircraft. The C-40A has already shown greater signs of reliability with respect to the availability of these aircraft for accomplishing the required mission. A recent comparison of the Navy's "Ready for Tasking" (RFT) rate from January 2008 to March 2009 showed the C-40A to be at 100% while the C-9B was only achieved an 86.9%. Therefore, risk associated with mission accomplishment should also be factored into the decision.



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XII. Conclusions and Recommendations

A. Conclusions

Step 9 of a CBA requires the analyst to make a recommendation based on the NPV and sensitivity analysis. As mentioned above, Boardman et al. (2006) recommends the analyst adopt the project with the largest NPV. This CBA analyzes the NPV of quantifiable impacts of O&S costs, fuel costs, MILPERS costs, modification costs, acquisition costs, and safety benefits. Using Boardman's NPV method, Alternative Three had a NPV of \$2.346 billion, which was the greatest of the three alternatives analyzed, since that NPV has a negative number of smallest magnitude. The NPV of Alternative One was \$2.484 billion, while Alternative Two was \$2.447 billion. However, as discussed in the previous chapter on Sensitivity Analysis, the qualitative impacts could have a more pronounced influence on the final decision than one using only the alternative with the highest NPV.

B. Recommendations

1. **Cost – The Department of the Navy should immediately resume the transition from C-9B aircraft to the C-40A as previously set forth per NAP 2030.**

If cost is the highest priority and the major focus of the decision-maker, then the recommended solution is Alternative Three. Alternative Three, the “accelerated” transition, has the lowest PV of cost of -\$2.346 billion.

2. **Competing Priorities – The Department of the Navy should continue as planned and resume the transition from the C-9B aircraft to the C-40A in FY 2015 or as early as possible.**

If competing priorities and a time of limited budget are the restrictions set forth for the decision-maker, then Alternative Two is the recommended solution.



Alternative Two, the “delayed” transition, comes at a cost of \$101 million more than that of Alternative Three. The decision-maker may deem a cost of \$101 million for a 5-year delay in completing the transition to C-40A aircraft a necessary expense. It is worth noting, however, that with a discount factor of 2.9% (as analyzed in the Sensitivity Analysis chapter), this 5-year delay could result in a cost of \$152 million.

C. Recommendations for Follow-up Study

During the course of this study on the costs/benefits associated with delaying the transition from C-9B aircraft to C-40A aircraft, we recognized a number of related issues the Department of the Navy may wish to analyze in future studies. In response to these issues, we make the following recommendations:

- Conduct a cost/benefit analysis study of the C-40 Flexible Maintenance Manpower Initiative currently in beta testing (Combination of military- and contract-supported maintenance).
- Conduct cost/benefit analysis of contractor-supported maintenance compared to maintenance performed by military personnel.
- Consider the effect of C-9B divestiture by commercial airlines on the spare parts availability for continued C-9B support by the US Navy.



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Appendix A. Operating and Support Costs Detailed

The Office of the Secretary of Defense (OSD) has established guidance on how to construct a complete Operating and Support (O&S) estimate (OSD, 2007). A complete estimate of O&S costs usually includes the costs of personnel, consumables, goods and services, and sustaining support and investments associated with the peacetime operation of a weapon system. Operations and Support costs will normally include all costs of operating, maintaining, and supporting a fielded system, as well as all costs for personnel; consumable and repairable materials; organizational, intermediate and depot maintenance; facilities; and sustaining investment. O&S costs are usually presented in constant dollars—either those of the current fiscal year or of a baseline year associated with the specific program.

Our analysis was based upon the data downloaded from the Visibility and Management of Operating and Support Cost (VAMOSC) management information system. VAMOSC is a web-enabled system that collects and reports US Navy and US Marine Corps Operating and Support (O&S) costs on an annual basis. The VAMOSC data has been shown to be supplemented with more specialized reliability and maintainability data, which has been obtained from military service maintenance data collection systems (Office of the Secretary of Defense, 2007). For our analysis, we used the data available from the Cost Analysis Improvement Group (CAIG) Aircraft Type/Model/Series Reports (ATMSR). Yearly cost data obtained from these ATMSR reports for both the C-9B and C-40A have been included in Appendix B. The cost data is separated into the following categories:

- 1.0 Organizational Level (Personnel, Operations, AVDLR, Fuel)
- 2.0 Intermediate Level (Personnel)
- 3.0 Depot Level (Aircraft & Engine Rework, Support Equipment Maintenance) Training
- 4.0 Recurring Investment Costs (Modification Kits, Spares & Installs)
- 5.0 Other Function Costs (Engineering Technical Services, Publications)
- 6.0 Contractor Logistic Support Costs



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Appendix B. VAMOSC Extract of Operating Costs

C-9B 1986	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1 Organizational Regular Military Personnel Costs	2,075,000	4,727,835	
1.1.3 Organizational Contractor Personnel Costs	15,000	24,910	
1.2.1 Temporary Additional Duty Costs	395,000	655,965	
1.2.3.1 Support Supplies Costs	7,711,182	12,805,736	
1.2.5.1 Fuel Costs	18,533,718	41,543,670	
3.1.2 Aircraft Rework Commercial Costs FY86-91	1,944,000	3,228,344	
4.2.2 Maintenance Training Costs	4,000	6,643	
6.2 Contractor Engineering and Technical Services Costs	910,000	1,511,211	
6.3 Publications Costs	346,000	574,592	
A1.1.1 Regular Aircraft Number			17
A2.1.1 Regular Annual Flying Hours			25,505
Total Then Year	\$31,933,900		
Total Constant Year		\$65,078,906	
Cost Per Aircraft	\$1,878,465	\$3,828,171	
Cost Per Flying Hour	\$1,252	\$2,552	



C-9B 1987	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1 Organizational Regular Military Personnel Costs	13,818,000	30,791,161	
1.1.3 Organizational Contractor Personnel Costs	45,000	72,554	
1.2.1 Temporary Additional Duty Costs	487,000	785,195	
1.2.3.1 Support Supplies Costs	7,114,703	11,471,103	
1.2.5.1 Fuel Costs	18,087,733	44,156,772	
2.1.1 Intermediate Military Personnel Costs	4,031,000	8,982,427	
2.1.2 Intermediate Civilian Personnel Costs	252,000	525,622	
2.1.3 Intermediate Contractor Personnel Costs	7,000	11,286	
3.1.2 Aircraft Rework—Commercial Costs FY86-91	1,763,000	2,842,502	
3.2.2 Engine Rework—Commercial Costs FY86-91	2,109,000	3,400,361	
3.4.1 Other Rework—Miscellaneous Depot Costs FY86-91	862,000	1,389,811	
4.2.2 Maintenance Training Costs	26,000	41,920	
6.1 Navy Engineering and Technical Services Costs	150,000	312,870	
6.2 Contractor Engineering and Technical Services Costs	941,000	1,517,183	
6.3 Publications Costs	67,000	108,025	
A1.1.1 Regular Aircraft Number			17
A2.1.1 Regular Annual Flying Hours			27,250
Total Then Year	49,760,436		
Total Constant Year		\$106,408,792	
Cost Per Aircraft	\$2,927,084	\$6,259,341	
Cost Per Flying Hour	\$1,826	\$3,905	



C-9B 1988	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1 Organizational Regular Military Personnel Costs	14,353,000	31,282,592	
1.1.3 Organizational Contractor Personnel Costs	45,000	70,414	
1.2.1 Temporary Additional Duty Costs	487,000	762,035	
1.2.3.1 Support Supplies Costs	8,430,078	13,190,992	
1.2.5.1 Fuel Costs	15,315,434	44,604,018	
2.1.1 Intermediate Military Personnel Costs	4,252,000	9,267,302	
2.1.2 Intermediate Civilian Personnel Costs	261,000	532,467	
2.1.3 Intermediate Contractor Personnel Costs	7,000	10,953	
3.1.2 Aircraft Rework Commercial Costs FY86-91	4,207,000	6,582,917	
3.2.2 Engine Rework Commercial Costs FY86-91	1,827,000	2,858,804	
4.2.2 Maintenance Training Costs	23,000	35,989	
6.2 Contractor Engineering and Technical Services Costs	652,000	1,020,219	
6.3 Publications Costs	1,000	1,565	
A1.1.1 Regular Aircraft Number			17
A2.1.1 Regular Annual Flying Hours			26,569
Total Then Year	\$49,860,512		
Total Constant Year		\$110,220,267	
Cost Per Aircraft	\$2,932,971	\$6,483,545	
Cost Per Flying Hour	\$1,877	\$4,148	



C-9B 1989	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1 Organizational Regular Military Personnel Costs	14,431,000	30,365,509	
1.2.3.1 Support Supplies Costs	9,994,306	14,977,250	
1.2.5.1 Fuel Costs	17,722,474	51,572,854	
2.1.1 Intermediate Military Personnel Costs	4,173,000	8,780,768	
3.1.2 Aircraft Rework Commercial Costs FY86-91	2,162,000	3,239,926	
3.2.1 Engine Rework Intra-DOD Costs FY86-91	45,000	67,436	
3.2.2 Engine Rework Commercial Costs FY86-91	9,200,000	13,786,920	
3.3.2 Component Rework-Commercial Costs FY86-91	455,000	681,853	
4.2.2 Maintenance Training Costs	9,000	13,487	
6.2 Contractor Engineering and Technical Services Costs	598,000	896,150	
A1.1.1 Regular Aircraft Number			17
A2.1.1 Regular Annual Flying Hours			31,400
Total Then Year	\$58,789,780		
Total Constant Year		\$124,382,153	
Cost Per Aircraft	\$3,458,222	\$7,316,597	
Cost Per Flying Hour	\$1,872	\$3,961	



C-9B 1990	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1 Organizational Regular Military Personnel Costs	19,974,000	40,521,608	
1.2.3.1 Support Supplies Costs	10,747,805	15,478,527	
1.2.5.1 Fuel Costs	16,385,643	53,445,066	
2.1.1 Intermediate Military Personnel Costs	2,706,000	5,489,710	
3.1.2 Aircraft Rework Commercial Costs FY86-91	557,000	802,167	
3.2.2 Engine Rework Commercial Costs FY86-91	6,130,000	8,828,163	
3.3.2 Component Rework-Commercial Costs FY86-91	472,000	679,754	
4.2.2 Maintenance Training Costs	10,000	14,402	
6.2 Contractor Engineering and Technical Services Costs	184,000	264,989	
A1.1.1 Regular Aircraft Number			17
A2.1.1 Regular Annual Flying Hours			32,266
Total Then Year	\$57,166,448		
Total Constant Year		\$125,524,386	
Cost Per Aircraft	\$3,362,732	\$7,383,787	
Cost Per Flying Hour	\$1,772	\$3,890	



C-9B 1991	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1 Organizational Regular Military Personnel Costs	21,732,000	42,400,552	
1.2.3.1 Support Supplies Costs	9,521,652	13,241,174	
1.2.5.1 Fuel Costs	19,100,603	33,278,009	
2.1.1 Intermediate Military Personnel Costs	4,131,000	8,059,851	
3.1.2 Aircraft Rework Commercial Costs FY86-91	4,667,000	6,490,109	
3.2.2 Engine Rework Commercial Costs FY86-91	5,676,000	7,893,263	
3.3.2 Component Rework-Commercial Costs FY86-91	3,792,000	5,273,300	
3.4.1 Other Rework - Miscellaneous Depot Costs FY86-91	123,000	171,049	
4.2.2 Maintenance Training Costs	25,000	34,766	
6.3 Publications Costs	42,000	58,407	
A1.1.1 Regular Aircraft Number			17
A2.1.1 Regular Annual Flying Hours			20,912
Total Then Year	\$68,810,255		
Total Constant Year		\$116,900,480	
Cost Per Aircraft	\$4,047,662	\$6,876,499	
Cost Per Flying Hour	\$3,290	\$5,590	



C-9B 1992	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1 Organizational Regular Military Personnel Costs	26,999,000	50,563,269	
1.1.3 Organizational Contractor Personnel Costs	378,000	513,582	
1.2.1 Temporary Additional Duty Costs	612,000	831,514	
1.2.3.1 Support Supplies Costs	10,669,907	14,497,019	
1.2.5.1 Fuel Costs	16,523,320	43,159,197	
2.1.1 Intermediate Military Personnel Costs	4,471,000	8,373,213	
2.1.2 Intermediate Civilian Personnel Costs	252,000	441,753	
2.1.3 Intermediate Contractor Personnel Costs	1,000	1,359	
3.1.2 Commercial Aircraft Rework Costs	6,880,000	9,347,738	
3.3.2 Commercial Aircraft Engine Rework Costs	8,203,000	11,145,275	
3.6.1 Organic Aircraft Emergency Repair Costs	294,000	445,345	
3.6.2 Commercial Aircraft Emergency Repair Costs	172,000	233,693	
3.6.3 DMISA Aircraft Emergency Repair Costs	4,000	5,435	
4.2.2 Maintenance Training Costs	6,000	8,152	
5.1.1 Modification Kit Costs	568,000	751,643	
5.1.2 Modification Spares Costs	27,000	35,730	
6.3 Publications Costs	123,000	167,118	
6.4 Aircraft Support Services Costs	5,000	6,793	
A1.1.1 Regular Aircraft Number			17
A2.1.1 Regular Annual Flying Hours			25,923
Total Then Year	\$16,282,000		
Total Constant Year		\$22,146,922	
Cost Per Aircraft	\$957,765	\$1,302,760	
Cost Per Flying Hour	\$628	\$854	



C-9B 1993	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1 Organizational Regular Military Personnel Costs	26,657,000	48,085,896	
1.1.3 Organizational Contractor Personnel Costs	46,000	61,169	
1.2.1 Temporary Additional Duty Costs	523,000	695,470	
1.2.3.1 Support Supplies Costs	11,557,316	15,368,583	
1.2.5.1 Fuel Costs	18,377,986	47,345,800	
2.1.1 Intermediate Military Personnel Costs	2,395,000	4,320,281	
2.1.2 Intermediate Civilian Personnel Costs	202,000	341,075	
2.1.3 Intermediate Contractor Personnel Costs	7,000	9,308	
3.1.2 Commercial Aircraft Rework Costs	12,232,000	16,265,758	
3.3.2 Commercial Aircraft Engine Rework Costs	7,089,000	9,426,746	
3.6.1 Organic Aircraft Emergency Repair Costs	281,000	413,540	
3.6.2 Commercial Aircraft Emergency Repair Costs	86,000	114,360	
4.2.2 Maintenance Training Costs	94,000	124,998	
5.1.1 Modification Kit Costs	484,000	628,761	
5.1.2 Modification Spares Costs	15,000	19,486	
6.3 Publications Costs	276,000	367,017	
6.4 Aircraft Support Services Costs	4,000	5,319	
A1.1.1 Regular Aircraft Number			17
A2.1.1 Regular Annual Flying Hours			28,079
Total Then Year	\$20,568,000		
Total Constant Year		\$27,375,293	
Cost Per Aircraft	\$1,209,882	\$1,610,311	
Cost Per Flying Hour	\$733	\$975	



C-9B 1994	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1 Organizational Regular Military Personnel Costs	25,701,000	45,204,165	
1.2.3.1 Support Supplies Costs	8,290,684	10,809,035	
1.2.5.1 Fuel Costs	16,117,733	36,390,020	
2.1.1 Intermediate Military Personnel Costs	2,618,000	4,604,665	
2.1.2 Intermediate Civilian Personnel Costs	50,000	83,671	
2.1.3 Intermediate Contractor Personnel Costs	2,000	2,608	
3.1.2 Commercial Aircraft Rework Costs	9,150,000	11,929,374	
3.3.2 Commercial Aircraft Engine Rework Costs	2,090,000	2,724,852	
3.6.1 Organic Aircraft Emergency Repair Costs	153,000	221,855	
3.6.2 Commercial Aircraft Emergency Repair Costs	312,000	406,772	
4.2.2 Maintenance Training Costs	138,000	179,918	
5.1.1 Modification Kit Costs	248,000	316,310	
5.1.2 Modification Spares Costs	22,000	28,060	
6.3 Publications Costs	78,000	101,693	
6.4 Aircraft Support Services Costs	7,000	9,126	
A1.1.1 Regular Aircraft Number			17
A2.1.1 Regular Annual Flying Hours			21,645
Total Then Year	\$12,200,000		
Total Constant Year		\$15,920,568	
Cost Per Aircraft	\$717,647	\$936,504	
Cost Per Flying Hour	\$564	\$736	



C-9B 1995	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1 Organizational Regular Military Personnel Costs	23,390,000	40,136,064	
1.2.3.1 Support Supplies Costs	9,036,403	11,566,188	
1.2.5.1 Fuel Costs	15,444,351	39,806,911	
2.1.1 Intermediate Military Personnel Costs	2,540,000	4,358,512	
2.1.2 Intermediate Civilian Personnel Costs	80,000	131,896	
2.1.3 Intermediate Contractor Personnel Costs	2,000	2,560	
3.1.2 Commercial Aircraft Rework Costs	1,096,000	1,402,830	
3.3.2 Commercial Aircraft Engine Rework Costs	5,862,000	7,503,095	
3.6.1 Organic Aircraft Emergency Repair Costs	172,000	245,204	
3.6.2 Commercial Aircraft Emergency Repair Costs	359,000	459,504	
3.8 Support Equipment Maintenance Costs	68,000	87,037	
4.2.2 Maintenance Training Costs	86,000	110,076	
5.1.1 Modification Kit Costs	771,000	967,809	
5.1.2 Modification Spares Costs	21,000	26,361	
6.1 Navy Engineering and Technical Services Costs	12,000	19,784	
6.2 Contractor Engineering and Technical Services Costs	214,000	273,910	
6.3 Publications Costs	90,000	115,196	
6.4 Aircraft Support Services Costs	4,000	5,120	
A1.1.1 Regular Aircraft Number			17
A2.1.1 Regular Annual Flying Hours			24,212
Total Then Year	\$1,797,000		
Total Constant Year		\$2,310,001	
Cost Per Aircraft	\$105,706	\$135,882	
Cost Per Flying Hour	\$74	\$95	



C-9B 1996	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1 Organizational Regular Military Personnel Costs	16,452,327	37,452,759	
1.2.3.1 Support Supplies Costs	2,571,000	12,818,891	
1.2.5.1 Fuel Costs	58,000	40,155,337	
2.1.1 Intermediate Military Personnel Costs	2,000	4,306,205	
2.1.2 Intermediate Civilian Personnel Costs	2,420,000	93,750	
2.1.3 Intermediate Contractor Personnel Costs	2,422,000	2,513	
3.1.2 Commercial Aircraft Rework Costs	87,000	3,040,261	
3.3.2 Commercial Aircraft Engine Rework Costs	45,000	3,042,773	
3.6.1 Organic Aircraft Emergency Repair Costs	43,000	121,685	
3.6.2 Commercial Aircraft Emergency Repair Costs	14,000	56,534	
3.8 Support Equipment Maintenance Costs	195,000	54,021	
4.2.2 Maintenance Training Costs	28,000	17,588	
5.1.1 Modification Kit Costs	26,000	241,385	
5.1.2 Modification Spares Costs	248,000	34,660	
6.1 Navy Engineering and Technical Services Costs	98,000	42,026	
6.2 Contractor Engineering and Technical Services Costs	5,000	311,564	
6.3 Publications Costs		123,118	
6.4 Aircraft Support Services Costs		6,282	
A1.1.1 Regular Aircraft Number			17
A2.1.1 Regular Annual Flying Hours			24,051
Total Then Year	\$657,000		
Total Constant Year		\$1,008,863	
Cost Per Aircraft	\$38,647	\$59,345	
Cost Per Flying Hour	\$27	\$42	



C-9B 1997	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	18,397,633	29,960,583	
1.2.3.1 Support Supplies Costs	10,019,909	12,408,138	
1.2.4.2 Commercial RoR Costs	13,000	17,816	
1.2.5.1 Fuel Costs	15,304,132	36,874,203	
2.1.1.1 Intermediate Level- Maint. MilPers Costs	38,810	63,201	
2.1.2 Intermediate Civilian Personnel Costs	108,000	169,896	
2.1.3 Intermediate Contractor Personnel Costs	2,000	2,477	
3.1.1.1 Organic Aircraft Rework Costs - Labor	321	440	
3.1.1.3 Organic Aircraft Rework Costs - Other	102	140	
3.1.2 Commercial Aircraft Rework Costs	12,798,432	15,848,918	
3.3.2 Commercial Aircraft Engine Rework Costs	4,520,727	5,598,235	
3.6.2 Commercial Aircraft Emergency Repair Costs	62,000	76,778	
3.6.3 DMISA Aircraft Emergency Repair Costs	1,000	1,238	
3.8 Support Equipment Maintenance Costs	60,000	74,301	
4.2.2 Maintenance Training Costs	5,000	6,192	
5.1.1 Modification Kit Costs	268,000	328,928	
5.1.2 Modification Spares Costs	24,000	29,456	
6.1 Navy Engineering and Technical Services Costs	31,000	48,766	
6.2 Contractor Engineering and Technical Services Costs	278,000	344,261	
6.3 Publications Costs	64,000	79,254	
6.4.1 Program Related Logistics Costs	4,000	4,953	
A1.1.1 Regular Aircraft Number			15
A2.1.1 Regular Annual Flying Hours			21,889
Total Then Year	\$62,000,066		
Total Constant Year		\$101,938,174	
Cost Per Aircraft	\$4,133,338	\$6,795,878	
Cost Per Flying Hour	\$2,832	\$4,657	



C-9B 1998	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	18,938,740	29,987,143	
1.2.3.1 Support Supplies Costs	11,033,706	13,539,844	
1.2.4.2 Commercial RoR Costs	13,000	17,493	
1.2.5.1 Fuel Costs	15,735,554	31,674,059	
2.1.1.1 Inter.- Maint. MilPers Costs	25,629	40,580	
3.1.1.1 Organic Aircraft Rework Costs - Labor	304	409	
3.1.1.3 Organic Aircraft Rework Costs - Other	327	440	
3.1.2 Commercial Aircraft Rework Costs	11,967,857	14,686,173	
3.3.2 Commercial Aircraft Engine Rework Costs	3,726,414	4,572,812	
3.6.2 Commercial Aircraft Emergency Repair Costs	138,000	169,345	
3.8 Support Equipment Maintenance Costs	30,000	36,814	
4.2.2 Maintenance Training Costs	39,000	47,858	
5.1.1 Modification Kit Costs	7,578,835	9,195,047	
5.1.2 Modification Spares Costs	52,413	63,590	
6.1 Navy Engineering and Technical Services Costs	30,000	45,886	
6.2 Contractor Engineering and Technical Services Costs	234,000	287,150	
6.3 Publications Costs	54,000	66,265	
A1.1.1 Regular Aircraft Number			13
A2.1.1 Regular Annual Flying Hours			18,725
Total Then Year	\$69,597,779		
Total Constant Year		\$104,430,908	
Cost Per Aircraft	\$5,353,675	\$8,033,147	
Cost Per Flying Hour	\$3,717	\$5,577	



C-9B 1999	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	18,003,992	27,569,717	
1.1.2 Organizational Civilian Personnel Costs	94,000	139,047	
1.2.1 Temporary Additional Duty Costs	5,000	6,078	
1.2.3.1 Support Supplies Costs	10,098,303	12,275,043	
1.2.4.2 Commercial RoR Costs	13,000	17,139	
1.2.5.1 Fuel Costs- Navy	14,533,012	32,074,895	
2.1.1.1 Inter.- Maint. MilPers Costs	28,288	43,316	
3.1.2 Commercial Aircraft Rework Costs	13,122,273	15,950,845	
3.3.2 Commercial Aircraft Engine Rework Costs	4,473,552	5,437,849	
3.6.2 Commercial Aircraft Emergency Repair Costs	256,000	311,182	
3.8 Support Equipment Maintenance Costs	59,000	71,718	
4.2.2 Maintenance Training Costs	32,000	38,898	
5.1.1 Modification Kit Costs	5,070,332	6,073,603	
5.1.2 Modification Spares Costs	55,193	66,114	
6.1 Navy Engineering and Technical Services Costs	31,000	45,856	
6.2 Contractor Engineering and Technical Services Costs	254,000	308,751	
6.3 Publications Costs	7,000	8,509	
6.4.1 Program-related Logistics Costs	563,000	684,357	
A1.1.1 Regular Aircraft Number			15
A2.1.1 Regular Annual Flying Hours			18,753
Total Then Year	\$66,698,945		
Total Constant Year		\$101,122,917	
Cost Per Aircraft	\$4,446,596	\$6,741,528	
Cost Per Flying Hour	\$3,557	\$5,392	



C-9B 2000	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	21,254,486	31,143,328	
1.2.3.1 Support Supplies Costs	1,102,929	1,321,797	
1.2.4.2 Commercial RoR Costs	4,000	5,129	
1.2.5.1 Fuel Costs- Navy	10,849,578	32,055,448	
2.1.1.1 Inter.- Maint. MilPers Costs	36,244	53,108	
2.1.2 Intermediate Civilian Personnel Costs	21,000	29,724	
2.1.3 Intermediate Contractor Personnel Costs	1,000	1,198	
3.1.2 Commercial Aircraft Rework Costs	12,387,530	14,845,738	
3.3.2 Commercial Aircraft Engine Rework Costs	6,250,310	7,490,635	
3.8 Support Equipment Maintenance Costs	68,000	81,494	
4.2.1 Operational Training Costs	23,000	27,564	
4.2.2 Maintenance Training Costs	20,000	23,969	
5.1.1 Modification Kit Costs	8,187,297	9,678,860	
5.1.2 Modification Spares Costs	71,228	84,204	
6.2 Contractor Engineering and Technical Services Costs	264,000	316,389	
6.4.1 Program-related Logistics Costs	512,000	613,602	
7.1.1 Contractor Logistics Support Costs	7,496,854	8,984,546	
A1.1.1 Regular Aircraft Number			15
A2.1.1 Regular Annual Flying Hours			18,007
Total Then Year	\$68,549,456		
Total Constant Year		\$106,756,733	
Cost Per Aircraft	\$4,569,964	\$7,117,116	
Cost Per Flying Hour	\$3,807	\$5,929	



C-9B 2001	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	20,658,014	29,114,808	
1.1.3 Organizational Contractor Personnel Costs	642	758	
1.2.1 Temporary Additional Duty Costs	1,178	1,391	
1.2.3.1 Support Supplies Costs	902,101	1,065,419	
1.2.5.1 Fuel Costs	13,983,470	25,361,964	
1.2.6.1 PCS Costs	346,396	488,201	
2.1.1.1 Inter.- Maint. MilPers Costs	25,718	36,246	
2.1.2 Intermediate Civilian Personnel Costs	97,195	132,324	
2.1.3 Intermediate Contractor Personnel Costs	290	343	
3.1.2 Commercial Aircraft Rework Costs	9,917,791	11,713,323	
3.3.2 Commercial Aircraft Engine Rework Costs	4,345,262	5,131,935	
3.6.2 Commercial Aircraft Emergency Repair Costs	602,678	711,788	
3.8 Support Equipment Maintenance Costs	38,160	45,069	
4.2.2 Maintenance Training Costs	4,678	5,525	
5.1.1 Modification Kit Costs	1,726,622	2,017,140	
5.1.2 Modification Spares Costs	33,582	39,232	
6.1 Navy Engineering and Technical Services Costs	30,460	41,469	
6.2 Contractor Engineering and Technical Services Costs	202,060	238,641	
6.3 Publications Costs	333	393	
6.4.1 Program-related Logistics Costs	1,211,286	1,430,579	
6.4.2 Program-related Engineering Costs	22,045	26,036	
7.1.1 Contractor Logistics Support Costs	7,435,728	8,781,903	
A1.1.1 Regular Aircraft Number			15
A2.1.1 Regular Annual Flying Hours			15,015
Total Then Year	\$61,585,689		
Total Constant Year		\$86,384,487	
Cost Per Aircraft	\$4,105,713	\$5,758,966	
Cost Per Flying Hour	\$4,102	\$5,753	



C-9B 2002	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	21,719,145	28,844,587	
1.2.3.1 Support Supplies Costs	528,622	617,194	
1.2.5.1 Fuel Costs	10,518,832	19,270,822	
1.2.6.1 PCS Costs	374,234	497,010	
2.1.1.1 Inter.- Maint. MilPers Costs	60,314	80,101	
2.1.2 Intermediate Civilian Personnel Costs	7,322	9,550	
3.1.2 Commercial Aircraft Rework Costs	8,477,232	9,897,617	
3.3.2 Commercial Aircraft Engine Rework Costs	3,493,812	4,079,210	
3.8 Support Equipment Maintenance Costs	75,057	87,633	
4.2.2 Maintenance Training Costs	28,077	32,781	
5.1.1 Modification Kit Costs	153,263	176,814	
5.1.2 Modification Spares Costs	12,217	14,094	
6.1 Navy Engineering and Technical Services Costs	33,559	43,771	
6.2 Contractor Engineering and Technical Services Costs	234,205	273,447	
6.3 Publications Costs	19,358	22,601	
6.4.1 Program-related Logistics Costs	1,761,034	2,056,100	
6.4.2 Program-related Engineering Costs	67,997	79,390	
7.1.1 Contractor Logistics Support Costs	6,461,845	7,544,546	
A1.1.1 Regular Aircraft Number			15
A2.1.1 Regular Annual Flying Hours			11,405
Total Then Year	\$54,026,125		
Total Constant Year		\$73,627,268	
Cost Per Aircraft	\$3,601,742	\$4,908,485	
Cost Per Flying Hour	\$4,737	\$6,456	



C-9B 2003	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	38,023,694	47,991,629	
1.2.3.1 Support Supplies Costs	986,274	1,137,339	
1.2.5.1 Fuel Costs	10,889,426	23,749,716	
1.2.6.1 PCS Costs	583,612	736,606	
2.1.1.1 Inter.- Maint. MilPers Costs	55,599	70,175	
2.1.2 Intermediate Civilian Personnel Costs	8,020	10,037	
3.1.2 Commercial Aircraft Rework Costs	6,413,214	7,395,511	
3.3.2 Commercial Aircraft Engine Rework Costs	2,778,982	3,204,632	
3.8 Support Equipment Maintenance Costs	81,579	94,074	
4.2.2 Maintenance Training Costs	25,890	29,856	
5.1.2 Modification Spares Costs	13,831	15,644	
5.1.4 Modification Kits and Installation Costs	785,123	888,038	
6.1 Navy Engineering and Technical Services Costs	39,683	49,662	
6.2 Contractor Engineering and Technical Services Costs	261,275	301,294	
6.3 Publications Costs	18,734	21,603	
6.4.1 Program-related Logistics Costs	1,918,110	2,211,902	
6.4.2 Program-related Engineering Costs	77,755	89,665	
7.1.1 Contractor Logistics Support Costs	7,638,395	8,808,350	
A1.1.1 Regular Aircraft Number			15
A2.1.1 Regular Annual Flying Hours			14,130
Total Then Year	\$70,599,196		
Total Constant Year		\$96,805,733	
Cost Per Aircraft	\$4,706,613	\$6,453,716	
Cost Per Flying Hour	\$4,996	\$6,851	



C-9B 2004	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	36,986,713	44,765,575	
1.2.3.1 Support Supplies Costs	758,498	852,247	
1.2.4.2 Commercial RoR Costs	3,555	4,104	
1.2.5.1 Fuel Costs	12,183,027	24,534,668	
1.2.6.1 PCS Costs	587,967	711,625	
2.1.1.1 Inter.- Maint. MilPers Costs	47,943	58,027	
2.1.2 Intermediate Civilian Personnel Costs	680	817	
2.1.3 Intermediate Contractor Personnel Costs	2,039	2,291	
3.1.2 Commercial Aircraft Rework Costs	15,240,291	17,123,972	
3.3.2 Commercial Aircraft Engine Rework Costs	2,092,321	2,350,929	
3.6.2 Commercial Aircraft Emergency Repair Costs	89,951	101,069	
3.8 Support Equipment Maintenance Costs	255,864	287,488	
4.2.1 Operational Training Costs	22,105	24,837	
4.2.2 Maintenance Training Costs	30,039	33,752	
5.1.2 Modification Spares Costs	35,745	39,391	
5.1.4 Modification Kits and Installation Costs	642,493	708,021	
6.1 Navy Engineering and Technical Services (NETS) Costs	43,467	52,255	
6.2 Contractor Engineering and Technical Services (CETS) Costs	324,797	364,942	
6.3 Publications Costs	22,802	25,620	
6.4.1 Program-related Logistics Costs	2,427,421	2,727,447	
6.4.2 Program-related Engineering Costs	114,371	128,507	
7.1.1 Contractor Logistics Support	8,764,839	9,848,162	
A1.1.1 Regular Aircraft Number			15
A2.1.1 Regular Annual Flying Hours			14,130
Total Then Year	\$80,676,928		
Total Constant Year		\$104,745,746	
Cost Per Aircraft	\$5,378,462	\$6,983,050	
Cost Per Flying Hour	\$5,710	\$7,413	



C-9B 2005	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	36,524,018	42,645,756	
1.2.3.1 Support Supplies Costs	1,160,616	1,268,856	
1.2.4.2 Commercial RoR Costs	2,680	3,000	
1.2.5.1 Fuel Costs	22,278,509	33,733,350	
1.2.6.1 PCS Costs	593,005	692,398	
2.1.1.1 Inter.- Maint. MilPers Costs	43,384	50,658	
2.1.2 Intermediate Civilian Personnel Costs	784	909	
3.1.1 Organic Aircraft Rework Costs	287	321	
3.1.1 Organic Aircraft Rework Costs	286	320	
3.1.2 Commercial Aircraft Rework Costs	14,366,704	15,706,558	
3.3.2 Commercial Aircraft Engine Rework Costs	3,006,115	3,286,468	
3.6.2 Commercial Aircraft Emergency Repair Costs	166,296	181,805	
3.8 Support Equipment Maintenance Costs	238,967	261,253	
4.2.1 Operational Training Costs	29,766	32,542	
4.2.2 Maintenance Training Costs	62,797	68,654	
5.1.2 Modification Spares Costs	30,573	32,769	
5.1.4 Modification Kits and Installation Costs	584,556	626,549	
6.1 Navy Engineering and Technical Services Costs	30,118	34,934	
6.2 Contractor Engineering and Technical Services Costs	8,839	9,663	
6.3 Publications Costs	18,338	20,048	
6.4.1 Program-related Logistics Costs	1,718,343	1,878,597	
6.4.2 Program-related Engineering Costs	138,418	151,327	
7.1.1 Contractor Logistics Support Costs	13,175,875	14,404,671	
A1.1.1 Regular Aircraft Number			15
A2.1.1 Regular Annual Flying Hours			16,926
Total Then Year	\$94,179,274		
Total Constant Year		\$115,091,406	
Cost Per Aircraft	\$6,278,618	\$7,672,760	
Cost Per Flying Hour	\$5,564	\$6,800	



C-9B 2006	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	39,821,452	45,055,252	
1.2.3.1 Support Supplies Costs	1,539,808	1,637,640	
1.2.5.1 Fuel Costs	23,620,247	22,395,093	
1.2.6.1 PCS Costs	394,835	446,729	
2.1.1.1 Inter.- Maint. MilPers Costs	80,089	90,614	
2.1.2 Intermediate Civilian Personnel Costs	2,803	3,150	
3.1.1.1 Organic Aircraft Rework Costs - Labor	287	312	
3.1.1.3 Organic Aircraft Rework Costs - Other	286	311	
3.1.2 Commercial Aircraft Rework Costs	10,907,005	11,599,985	
3.3.2 Commercial Aircraft Engine Rework Costs	6,932,510	7,372,969	
3.6.2 Commercial Aircraft Emergency Repair Costs	543,752	578,299	
3.8 Support Equipment Maintenance Costs	79,256	84,292	
4.2.1 Operational Training Costs	176,580	187,799	
4.2.2 Maintenance Training Costs	23,930	25,450	
5.1.2 Modification Spares Costs	25,344	26,432	
5.1.4 Modification Kits and Installation Costs	637,265	664,619	
6.1 Navy Engineering and Technical Services Costs	44,494	50,009	
6.2 Contractor Engineering and Technical Services Costs	383,933	408,326	
6.3 Publications Costs	38,467	40,911	
6.4.1 Program-related Logistics Costs	1,233,028	1,311,369	
6.4.2 Program-related Engineering Costs	132,014	140,402	
7.1.1 Contractor Logistics Support Costs	13,709,166	14,580,182	
A1.1.1 Regular Aircraft Number			15
A2.1.1 Regular Annual Flying Hours			15,998
Total Then Year	\$100,326,551		
Total Constant Year		\$106,700,145	
Cost Per Aircraft	\$6,688,437	\$7,113,343	
Cost Per Flying Hour	\$6,271	\$6,670	



C-9B 2007	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	43,834,052	48,423,444	
1.2.3.1 Support Supplies Costs	1,192,105	1,235,987	
1.2.5.1 Fuel Costs	30,975,200	28,963,070	
1.2.6.1 PCS Costs	681,311	752,644	
2.1.1.1 Inter.- Maint. MilPers Costs	67,225	74,264	
2.1.2 Intermediate Civilian Personnel Costs	1,773	1,946	
3.1.2 Commercial Aircraft Rework Costs	16,272,210	16,871,203	
3.3.2 Commercial Aircraft Engine Rework Costs	4,195,140	4,349,566	
3.6.2 Commercial Aircraft Emergency Repair Costs	51,901	53,812	
3.8 Support Equipment Maintenance Costs	129,917	134,699	
4.2.1 Operational Training Costs	88,169	91,415	
4.2.2 Maintenance Training Costs	67,938	70,439	
5.1.2 Modification Spares Costs	14,919	15,205	
5.1.4 Modification Kits and Installation Costs	673,456	686,377	
6.1 Navy Engineering and Technical Services Costs	40,389	44,323	
6.2 Contractor Engineering and Technical Services Costs	462,626	479,656	
6.3 Publications Costs	26,416	27,388	
6.4.1 Program-related Logistics Costs	1,797,890	1,864,072	
6.4.2 Program-related Engineering Costs	128,973	133,721	
7.1.1 Contractor Logistics Support Costs - Regular - Navy	28,671,807	29,727,238	
A1.1.1 Regular Aircraft Number			15
A2.1.1 Regular Annual Flying Hours			15,754
Total Then Year	\$129,373,417		
Total Constant Year		\$134,000,469	
Cost Per Aircraft	\$8,624,894	\$8,933,365	
Cost Per Flying Hour	\$8,212	\$8,506	



C-9B 2008	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	45,245,573	48,442,157	
1.2.3.1 Support Supplies Costs	1,687,069	1,714,777	
1.2.5.1 Fuel Costs	43,432,024	30,059,738	
1.2.6.1 PCS Costs	762,573	816,449	
2.1.1.1 Inter.- Maint. MilPers Costs	196,768	210,671	
2.1.2 Intermediate Civilian Personnel Costs	453	482	
3.1.2 Commercial Aircraft Rework Costs	2,410,272	2,449,857	
3.3.2 Commercial Aircraft Engine Rework Costs	10,145,775	10,312,405	
3.6.2 Commercial Aircraft Emergency Repair Costs	240,982	244,940	
3.8 Support Equipment Maintenance Costs	155,068	157,615	
4.2.1 Operational Training Costs	224,346	228,031	
4.2.2 Maintenance Training Costs	43,812	44,532	
5.1.2 Modification Spares Costs	109,380	109,831	
5.1.4 Modification Kits and Installation Costs	593,652	596,102	
6.1 Navy Engineering and Technical Services Costs	39,894	42,430	
6.2 Contractor Engineering and Technical Services Costs	468,639	476,336	
6.3 Publications Costs	30,777	31,282	
6.4.1 Program-related Logistics Costs	1,776,037	1,805,206	
6.4.2 Program-related Engineering Costs	132,062	134,231	
7.1.1 Contractor Logistics Support	17,016,785	17,296,261	
A1.1.1 Regular Aircraft Number			15
A2.1.1 Regular Annual Flying Hours			15,509
Total Then Year	\$124,711,941		
Total Constant Year		\$115,173,333	
Cost Per Aircraft	\$8,314,129	\$7,678,222	
Cost Per Flying Hour	\$8,041	\$7,426	



C-40A 2002	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	12,944,543	17,191,282	
1.2.3.1 Support Supplies Costs	390,951	456,456	
1.2.5.1 Fuel Costs	5,659,499	10,368,375	
1.2.6.1 PCS Costs	197,513	262,311	
2.1.1.1 Inter.- Maint. MilPers Costs	5,774	7,667	
2.1.2 Intermediate Civilian Personnel Costs	471	614	
3.6.2 Commercial Aircraft Emergency Repair Costs	60,798	70,985	
5.1.1 Modification Kit Costs	50,459	58,213	
5.1.2 Modification Spares Costs	4,072	4,698	
6.1 Navy Engineering and Technical Services Costs	11,186	14,590	
6.2 Contractor Engineering and Technical Services Costs	370,714	432,828	
6.3 Publications Costs	6,453	7,534	
6.4.1 Program-related Logistics Costs	1,642,491	1,917,695	
6.4.2 Program-related Engineering Costs	22,666	26,464	
7.1.1 Contractor Logistics Support	12,791,869	14,935,183	
A1.1.1 Regular Aircraft Number			5
A2.1.1 Regular Annual Flying Hours			7,559
Total Then Year	\$34,159,459		
Total Constant Year		\$45,754,895	
Cost Per Aircraft	\$6,831,892	\$9,150,979	
Cost Per Flying Hour	\$4,519	\$6,053	



C-40A 2003	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	21,680,541	27,364,107	
1.2.3.1 Support Supplies Costs	652,054	751,928	
1.2.5.1 Fuel Costs	7,035,500	15,344,347	
1.2.6.1 PCS Costs	313,169	395,266	
2.1.1.1 Inter.- Maint. MilPers Costs	36,325	45,847	
2.1.2 Intermediate Civilian Personnel Costs	2,804	3,509	
3.1.2 Commercial Aircraft Rework Costs	2,454,008	2,829,883	
3.3.2 Commercial Aircraft Engine Rework Costs	224,295	258,650	
3.6.2 Commercial Aircraft Emergency Repair Costs	3,336,276	3,847,285	
4.2.2 Maintenance Training Costs	3,438	3,965	
5.1.2 Modification Spares Costs	5,532	6,257	
5.1.4 Modification Kits and Installation Costs	314,049	355,215	
6.1 Navy Engineering and Technical Services Costs	15,873	19,865	
6.2 Contractor Engineering and Technical Services Costs	591,739	682,374	
6.3 Publications Costs	7,493	8,641	
6.4.1 Program-related Logistics Costs	2,472,894	2,851,661	
6.4.2 Program-related Engineering Costs	31,102	35,866	
7.1.1 Contractor Logistics Support	16,858,200	19,440,330	
A1.1.1 Regular Aircraft Number			6
A2.1.1 Regular Annual Flying Hours			10,994
Total Then Year	\$56,035,292		
Total Constant Year		\$74,244,996	
Cost Per Aircraft	\$9,339,215	\$12,374,166	
Cost Per Flying Hour	\$5,097	\$6,753	



C-40A 2004	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	19,943,075	24,137,405	
1.2.3.1 Support Supplies Costs	669,754	752,535	
1.2.4.2 Commercial RoR Costs	1,422	1,642	
1.2.5.1 Fuel Costs	8,438,760	16,994,313	
1.2.6.1 PCS Costs	422,482	511,336	
2.1.1.1 Inter.- Maint. MilPers Costs	19,144	23,169	
2.1.2 Intermediate Civilian Personnel Costs	366	440	
3.1.2 Commercial Aircraft Rework Costs	486,500	546,631	
3.8 Support Equipment Maintenance Costs	362,908	407,763	
4.2.2 Maintenance Training Costs	552	620	
5.1.2 Modification Spares Costs	14,298	15,756	
5.1.4 Modification Kits and Installation Costs	256,997	283,208	
6.1 Navy Engineering and Technical Services Costs	17,387	20,902	
6.2 Contractor Engineering and Technical Services Costs	608,516	683,728	
6.3 Publications Costs	9,121	10,248	
6.4.1 Program-related Logistics Costs	2,367,850	2,660,513	
6.4.2 Program-related Engineering Costs	45,748	51,402	
7.1.1 Contractor Logistics Support	18,430,128	20,708,069	
A1.1.1 Regular Aircraft Number			6
A2.1.1 Regular Annual Flying Hours			12,184
Total Then Year	\$52,095,008		
Total Constant Year		\$67,809,680	
Cost Per Aircraft	\$8,682,501	\$11,301,613	
Cost Per Flying Hour	\$4,276	\$5,565	



C-40A 2005	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	21,525,435	25,133,280	
1.2.3.1 Support Supplies Costs	659,226	720,706	
1.2.4.2 Commercial RoR Costs	1,429	1,600	
1.2.5.1 Fuel Costs	13,955,270	21,130,588	
1.2.6.1 PCS Costs	279,930	326,849	
2.1.1.1 Inter.- Maint. MilPers Costs	8,789	10,262	
2.1.2 Intermediate Civilian Personnel Costs	66	77	
3.1.2 Commercial Aircraft Rework Costs	1,445,311	1,580,102	
3.8 Support Equipment Maintenance Costs	145,499	159,068	
4.2.2 Maintenance Training Costs	53,160	58,118	
5.1.2 Modification Spares Costs	16,306	17,477	
5.1.4 Modification Kits and Installation Costs	311,763	334,159	
6.1 Navy Engineering and Technical Services Costs	16,063	18,631	
6.2 Contractor Engineering and Technical Services Costs	4,714	5,154	
6.3 Publications Costs	9,780	10,692	
6.4.1 Program-related Logistics Costs	2,236,108	2,444,650	
6.4.2 Program-related Engineering Costs	73,823	80,708	
7.1.1 Contractor Logistics Support	14,990,777	16,388,832	
A1.1.1 Regular Aircraft Number			8
A2.1.1 Regular Annual Flying Hours			12,803
Total Then Year	\$55,733,449		
Total Constant Year		\$68,420,953	
Cost Per Aircraft	\$6,966,681	\$8,552,619	
Cost Per Flying Hour	\$4,353	\$5,344	



C-40A 2006	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	33,103,594	37,454,455	
1.2.3.1 Support Supplies Costs	735,434	782,160	
1.2.5.1 Fuel Costs	23,911,139	22,670,896	
1.2.6.1 PCS Costs	445,525	504,081	
2.1.1.1 Inter.- Maint. MilPers Costs	1,750	1,980	
3.1.2 Commercial Aircraft Rework Costs	938,092	997,694	
3.8 Support Equipment Maintenance Costs	47,554	50,575	
4.2.2 Maintenance Training Costs	37,432	39,810	
5.1.2 Modification Spares Costs	15,206	15,859	
5.1.4 Modification Kits and Installation Costs	382,359	398,772	
6.1 Navy Engineering and Technical Services Costs	26,696	30,005	
6.2 Contractor Engineering and Technical Services Costs	5,750	6,115	
6.3 Publications Costs	23,080	24,546	
6.4.1 Program-related Logistics Costs	3,556,673	3,782,647	
6.4.2 Program-related Engineering Costs	79,208	84,241	
7.1.1 Contractor Logistics Support Costs	17,835,479	18,968,662	
A1.1.1 Regular Aircraft Number			9
A2.1.1 Regular Annual Flying Hours			13,708
Total Then Year	\$81,144,971		
Total Constant Year		\$85,812,498	
Cost Per Aircraft	\$9,016,108	\$9,534,722	
Cost Per Flying Hour	\$5,920	\$6,260	



C-40A 2007	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	34,026,123	37,588,632	
1.2.3.1 Support Supplies Costs	778,281	806,930	
1.2.5.1 Fuel Costs	23,509,200	21,982,057	
1.2.6.1 PCS Costs	377,303	416,806	
2.1.1.1 Inter.- Maint. MilPers Costs	2,280	2,519	
3.1.2 Commercial Aircraft Rework Costs	2,921,680	3,029,229	
3.6.2 Commercial Aircraft Emergency Repair Costs	6,134	6,360	
3.8 Support Equipment Maintenance Costs	77,950	80,819	
4.2.2 Maintenance Training Costs	37,217	38,587	
5.1.2 Modification Spares Costs	8,951	9,123	
5.1.4 Modification Kits and Installation Costs	404,074	411,827	
6.1 Navy Engineering and Technical Services Costs	24,233	26,593	
6.2 Contractor Engineering and Technical Services Costs	9,990	10,358	
6.3 Publications Costs	15,850	16,433	
6.4.1 Program-related Logistics Costs	3,995,784	4,142,872	
6.4.2 Program-related Engineering Costs	77,384	80,233	
7.1.1 Contractor Logistics Support	17,320,797	17,958,389	
A1.1.1 Regular Aircraft Number			9
A2.1.1 Regular Annual Flying Hours			13,566
Total Then Year	\$83,593,231		
Total Constant Year		\$86,607,767	
Cost Per Aircraft	\$9,288,137	\$9,623,085	
Cost Per Flying Hour	\$6,162	\$6,384	



C-40A 2008	Then Year Dollars	Constant FY 10 Dollars	Count
1.1.1.1 Org. Reg- MilPers Costs	35,796,399	38,325,403	
1.2.3.1 Support Supplies Costs	704,172	715,737	
1.2.5.1 Fuel Costs	31,189,290	21,586,420	
1.2.6.1 PCS Costs	545,435	583,970	
2.1.1.1 Inter.- Maint. MilPers Costs	79,429	85,042	
3.1.2 Commercial Aircraft Rework Costs	3,328,230	3,382,891	
3.6.2 Commercial Aircraft Emergency Repair Costs	100,000	101,642	
3.8 Support Equipment Maintenance Costs	93,041	94,569	
4.2.2 Maintenance Training Costs	27,062	27,506	
5.1.2 Modification Spares Costs	65,628	65,899	
5.1.4 Modification Kits and Installation Costs	356,191	357,661	
6.1 Navy Engineering and Technical Services Costs	22,900	24,356	
6.2 Contractor Engineering and Technical Services Costs	4,622	4,698	
6.3 Publications Costs	18,466	18,769	
6.4.1 Program-related Logistics Costs	3,713,657	3,774,649	
6.4.2 Program-related Engineering Costs	79,237	80,538	
7.1.1 Contractor Logistics Support Costs	20,089,696	20,419,641	
A1.1.1 Regular Aircraft Number			9
A2.1.1 Regular Annual Flying Hours			12,597
Total Then Year	\$96,213,455		
Total Constant Year		\$89,649,391	
Cost Per Aircraft	\$10,690,384	\$9,961,043	
Cost Per Flying Hour	\$7,638	\$7,117	



Appendix C. List of Acronyms

AVDLR	Aviation Depot-level Repairables
CBA	Cost-benefit Analysis
CFLSW	Commander, Fleet Logistics Support Wing
CNAFR	Commander, Naval Air Force Reserves
CNO	Chief of Naval Operations
CONUS	Continental United States
DoD	Department of Defense
FAA	Federal Aviation Administration
FAR	Federal Aviation Requirement
FY	Fiscal Year
HAZREP	Hazardous Report
NAS	Naval Air Station
NAVAIR	Naval Air Systems Command
NUFEA	Navy Unique, Fleet Essential Aircraft
SDLM	Standard Depot-level Maintenance
SLEP	Service-life Extension Program
T/M/S	Type/Model/Series
USMC	United States Marine Corps
USN	United States Navy
VAMOSC	Visibility and Management of Operating and Support Costs



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Appendix D. Glossary of Terms

Apportionment. An authorization established by an Act of Congress of the United States to spend funds of the US Treasury, or incur indebtedness, for specified purposes. Appropriations fund, among other things, the operation and maintenance requirements of the operating forces. The appropriation is only available for citation on requisitions for the fiscal year established and for the recording of related expenditures for the following 2 years thereafter.

Aviation Depot Level Repairable (AVDLR). These are the repairable spare parts that support Naval Aviation. Prior to April 1985, new repairable spare parts were purchased from the appropriation procurement account. Repairable items were reworked by the depot maintenance activities and financed by an O&M account and not charged against the Flight Hour Program (FHP).

Aviation Depot Level Repairable (AVDLR) Cost. Identifies the sum of the reported Aviation Depot Level Repairable (AVDLR) cost for the reported Work Unit Code (WUC). AVDLR costs pertain to repairable items that were removed at the intermediate level of maintenance and sent as a Beyond-Capable Maintenance (BCM) to the depot for repair. The AVDLR cost for a particular National Item-Identification Number (NIIN) is the Net Price, or the price that the fleet is charged after turning in a carcass. The Net Price is comprised of two components: the Item Repair Cost, which is the price that NAVICP pays the Organic Depot, Interservice Depot, or Commercial Source to repair an item; and the Cost Recovery Rate, which is the cost of supply-system operations.

Commander Fleet Logistics Support Wing. The Fleet Logistics Support Wing (FLSW) was established to operate Navy Unique Fleet Essential Airlift (NUFEA) aircraft on a worldwide basis to provide responsive, flexible, and rapidly deployable air logistics support required to sustain combat operations for the sea.



During peacetime, squadrons provide air logistics support for all Navy commands as well as provide continuous quality training for mobilization readiness. The CFLSW staff consists of 56 military and two civilians that are specifically tasked with providing administrative, personnel, material, and training support to units assigned. A comprehensive Quality Visit program has been implemented to maintain standardization and maximum readiness support for subordinate units. CFLSW is the model manager for the C-9, C-20, C-37, C-40 and C-130 aircraft.

Commander Naval Air Force Reserves. The Naval Air Force Reserve is CFLSW's Type Commander (TYCOM) and is commanded by a Rear Admiral and is headquartered in New Orleans, LA. Today's Naval Air Force had its genesis in 1946 with the establishment of the Naval Air Reserve Training Command, headquartered at Naval Air Station Glenview, IL. In 1973, the air and surface training commands were combined in New Orleans, LA, under the Chief of Naval Reserve who reports directly to the Chief of Naval Operations. In 1983, the Naval Air Force Reserve was established as a separate command with the Naval Reserve Force structure and was directed from New Orleans by a Rear Admiral. In 2002, Commander, Naval Air Reserve was disestablished and the Naval Air Force Reserve was formed.

Consumable Cost. The cost of replacement for an item that is not intended to be repaired (i.e., a disposable item). The cost of consumables is obtained by using the standard price for that item from the Consumables Price File. The Standard Price is comprised of two components: the Replacement Price, which is the price that NAVICP of DLA pays the contractor for a new part; and the Cost Recovery Rate, which is the cost of supply system operations.

Department of Defense (DoD). The department of the US government responsible for the management and funding of the armed forces in the defense of a threat of war against the United States and for any other tasks as designated by the President and Congress.



Defense Logistics Agency (DLA). The Department of Defense's largest logistics combat support agency, providing worldwide logistics support in both peacetime and wartime to the military services as well as to several civilian agencies and foreign countries. The DLA employs about 23,000 employees. The Agency's headquarters is at Fort Belvoir in Northern Virginia.

Discount Rate. The interest rate used in calculating the present value of expected yearly benefits and costs.

Discount Factor. The factor that translates expected benefits or costs in any given future year into present value terms. The discount factor is equal to $1/(1 + i)^t$ where i is the interest rate and t is the number of years from the date of initiation for the program or policy until the given future year.

Fiscal Year (FY). The Fiscal Year corresponds to the annual budget and appropriations schedule and reflects the period defined by the calendar dates 01 October of the previous year through the following 30 September.

Five-year Defense Program (FYDP). The major financial performance plan of the Department of Defense for accomplishment within a 5-year period. The FYDP structure provides a method of aggregating forces, money, and manpower within one of 10 major categories or building blocks classified as major programs. The 10 major programs, which form the entire defense posture into broad functional classifications of similar military missions, are as follows:

Program I – Strategic Forces

Program II – General Purpose Forces (majority of Navy operating forces assigned)

Program III – Intelligence and Communications

Program IV – Airlift and Sealift

Program V – Guard and Reserve Forces



Program VI – Research and Development

Program VII – Central Supply and Maintenance

Program VIII – Training, Medical, and other general personnel activities

Program IX – Administration and Associated Activities

Program X – Support of other Nations

I-Level Maintenance Activity. Intermediate maintenance (I-Level) is performed by designated maintenance activities that have responsibility for direct support of using organizations. Its phases normally consist of calibration, repair or replacement of damaged or unserviceable parts, components, or non-available parts, and provisions of technical assistance to using organizations.

Inflation. The proportionate rate of change in the general price level, as opposed to the proportionate increase in a specific price. Inflation is usually measured by a broad-based price index, such as the implicit deflator for Gross Domestic Product or the Consumer Price Index.

Internal Rate of Return. The discount rate that sets the net present value of the stream-of-net benefits equal to zero. The internal rate of return may have multiple values when the stream-of-net benefits alternates from negative to positive more than once.

Lifecycle Cost. The overall estimated cost for a particular program alternative over the time period corresponding to the life of the program, including direct and indirect initial costs plus any periodic or continuing costs of operation and maintenance.

Major Claimant. Bureau, office, or command (e.g., COMNAVAIRFOR) designated as an administering office under the operation and maintenance appropriation that receive operating budgets directly from the CNO.



Naval Air Systems Command (NAVAIR). One of the five Navy system's commands. NAVAIR is responsible for the acquisition of aircraft and other aviation-related weapons systems, as well as managing the associated logistical support infrastructure.

Naval Center for Cost Analysis (NCCA). A Navy activity responsible for guiding cost analyses within the Department of the Navy. Serves as an advisor to the Assistant Secretary of the Navy for Financial Management and Comptroller (ASN(FMC)), and manages the Navy VAMOSC program.

Naval Inventory Control Point (NAVICP). Two field activities exist within the Naval Supply Systems Command (NAVSUP). One is located in Mechanicsburg, PA, the other in Philadelphia, PA. They maintain Navy-wide control systems, and also perform the functions of a stock control activity. The NAVICP in Philadelphia has primary responsibility for the inventory management of aviation-related items.

Navy Unique Essential Fleet Aircraft (NUFEA). NUFEA aircraft provide Combatant Commander-controlled airlift assets deemed essential for providing air transportation in support of naval operations' transportation requirements. This capability is intended to provide a balance and supplement to other airlift assets to ensure the Navy's ability to respond to emergency and wartime requirements. The NUFEA aircraft also provides Combatant Commanders with short-notice, quick-response, and intra-theater logistics support via medium and heavy-lift capabilities in direct support of the Fleet requirements.

Net Present Value. The difference between the discounted present value of benefits and the discounted present value of costs.



O-Level Maintenance Activity. Organizational maintenance (O-Level) is the lowest level of maintenance performed on an aircraft. It is squadron-level activity, and includes inspecting, servicing, lubricating, and replacing WRAs.

OFC. A system whereby the various categories of O&M budgeting and funding are assigned a numerical designator. Each OFC supports a particular function/purpose.

OP-20. A Department of the Navy (DON) planning document published by the Special Assistant for the FHP several times per year to establish the annual flying hours by Type/Model/Series (TMS), which is used for FHP funding and fleet planning. Requirements are computed using historical data and are revised with FMF inputs. The OP-20 shows: required hours computed from factors of Primary Mission Readiness (PMR) requirements, crew seat ratios, force structure, and staff hours; budgeted hours computed as a percentage of PMR; cost per hour by TMS; total costs by budget line item; and total TMS costs.

OFC-50 Aviation Fleet Maintenance (AFM). Funding for AFM of aircraft. Includes the cost of material used in support of the aircraft such as consumable repair parts and paints, petroleum, oil, lubricants used in intermediate and direct organic maintenance of aircraft. AFM is one of three components of OP-20 Cost Per Hour (CPH).

Real or Constant Dollar Value. Economic units measured in terms of constant purchasing power. A real value is not affected by general price inflation. Real values can be estimated by deflating nominal values with a general price index, such as the implicit deflator for Gross Domestic Product or the Consumer Price Index.

Real Interest Rate. An interest rate that has been adjusted to remove the effect of expected or actual inflation. Real interest rates can be approximated by subtracting the expected or actual inflation rate from a nominal interest rate. (A



precise estimate can be obtained by dividing the nominal interest rate plus one, by the expected or actual inflation rate plus one, and then subtracting one from the resulting quotient.)

TMS. The specific designation of aircraft used by the military and by the DON Flight Hour Program for planning and funding. Type refers to the mission of the aircraft, such as cargo/logistic (C). Model identifies the particular airframe in that mission category, such as C-40. Series is a particular configuration within the model, such as the C-40A. The series designation also indicates equipment that is installed onboard that gives the aircraft individual mission or performance capabilities. In most cases, the later the letter designator, the newer the series.

Treasury Rates. Rates of interest on marketable Treasury debt. Such debt is issued in maturities ranging from 91 days to 30 years.

Visibility and Management of Operating and Support Cost (VAMOSC). A Naval program which presents the direct costs for ships, aircraft, and weapons systems. VAMOSC is capable of providing cost data across the gamut of naval activity, from high-level aggregate reports to detailed reports on individual systems during specific time periods.



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