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Cost benefit analysis of the Department of the Navy's F-5 Tiger II contract

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MBA PROFESSIONAL REPORT

Cost Benefit Analysis of
The Department of the Navy's F-5 Tiger II Contract

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December 2003

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COST BENEFIT ANALYSIS OF THE DEPARTMENT OF THE NAVY'S F-5 TIGER II CONTRACT

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COST BENEFIT ANALYSIS OF THE NAVY'S F-5 TIGER II CONTRACT

ABSTRACT

This project consists of a Cost Benefit Analysis (CBA) of the costs, issues and effects associated with replacing the F-5E/F Tiger II aircraft with F/A-18A/B. The three alternatives analyzed are (1) continued operation of the F-5E/F, (2) replacement of the F-5 with F/A-18A/B by 2008, and (3) installation of 4th generation pulse-doppler radar in the F-5E/F by 2008. The objective was to compare the three alternatives, choosing the alternative which provides the greatest net benefit and most efficient use of resources. The analysis involved data collection of operational costs per flight hour, total cost over the life of the program, and Contractor supported maintenance. Data for this research project were gathered from the actual maintenance contracts for both the F-5E/F Tiger and F/A-18A/B aircraft at Fallon, NV, Naval Aviation Systems Command, and OFC-20. Our results suggest that NAVAIR should continue to use the F-5E/F Tiger II aircraft for the VFC-13 adversary training mission through 2014.

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I. BACKGROUND

In response to increasing defense budget scrutiny and a desire for smarter spending, the Office of the Chief of Naval Aviation (N-78) is actively pursuing several initiatives to reduce the variety of naval aircraft in service and their associated support costs. The US Navy currently operates 68 different type/model/series (T/M/S) aircraft.[1] The F-5 Tiger II aircraft is a candidate for retirement because of its sole mission to provide adversary training.

The Navy's history with adversary training began when it instituted formal Dissimilar Air Combat Training (DACT) program in 1968 by establishing the US Navy Postgraduate Course in Fighter Weapons Tactics and Doctrine at NAS Miramar, which is better known as Top Gun. A detailed history of the US Navy's aggressor squadrons is included in appendix A. DACT was established in response to relatively poor naval air-to-air combat in Vietnam--the kill ratio being only about two to one in favor of the Navy, which was far from satisfactory[2]. The first DACT course convened in March 1969.

Initially DACT emphasized close-in, air-to-air dogfighting. This tactic had become almost obsolete because of the usage of air-to-air missiles in combat. The DACT program taught student aviators to pay closer attention to the flying characteristics of aircraft flown by the enemy. The Douglas A-4 Skyhawk attack aircraft and Northrop T-38A Talon trainers were used as adversary aircraft because they were small, highly maneuverable, and well suited to simulate the Soviet fighters of the day. The adversary aircraft were painted with enemy camouflage schemes, enabling students to visually recognize potential enemies.

This program was successful in improving the Navy's kill ratio in combat over Vietnam, and by 1972, the Navy's kill ratio in air-to-air combat had increased to about 12 to 1[3]. The success of the program resulted in the Top Gun program being elevated in

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[1] Optimizing the Size of Naval Aviation's Aircraft Inventory, Naval Air Systems Command, PowerPoint Presentation April 24,2003.

[2] http://home.att.net/~jbaugher1/f5_28.html Northrop F-5E/F Tiger II for US Navy. January 2, 2000.

[3] Ibid

status to that of a separate establishment in July 1, 1972, when it formally adopted the title Navy Fighter Weapons School (NFWS). At the same time, it was decided to expand the Top Gun program beyond NFWS at Miramar. Hence, the Navy set up dedicated full-time adversary squadrons at both NAS Oceana, Virginia and at NAS Miramar, California. These squadrons were designated VF-43 "Challengers" and VF-126 "Bandits."

In February 1970, VF-126 commenced DACT when it received four A-4s for instrument and countermeasures training. In 1981, VF-126 relinquished its instrument training responsibilities to VA-127 and become a dedicated adversary unit. VF-126 acquired three F-5Es from VF-43 when that unit re-equipped with F-21As. In 1990, VF-126 decommissioned in September of 1993 and handed over its responsibilities to VFC-13 and their F/A-18s.

In 1975, the US Navy Fighter Weapons School obtained ten F-5Es and three F-5Fs from the USAF for use in dissimilar air combat training. After providing dissimilar air combat opportunities to the fighter communities on the East and West Coasts, the Navy went on to provide similar opportunities to light attack A-7 Corsair squadrons. These were VA-45 at Cecil Field, Florida (later relocated to NAS Key West, Florida where it was eventually redesignated VF-45 "Blackbirds") and VA-127 at Lemoore, California (later relocated to NAS Fallon, Nevada, where it was redesignated VFA-127).

The NAS Lemoore-based VA-127 was initially a West Coast A-4 replacement squadron. In July 1975, VA-127 became an instrument training squadron. VA-127 acquired a DACT role in November 1975 and ceased its instrument training entirely in October of 1983. Its primary mission was now to provide adversary training for West Coast attack and light attack squadrons. In 1987, the squadron was redesignated VFA-127 "Desert Bogeys"/"Cylons" and moved to NAS Fallon, Nevada and operated VF-45's excess F-5Es. In late 1988, VFA-127 obtained eight more F-5Es from USAF aggressor units. VFA-127 replaced its A-4s with F/A-18s in 1992, but retained its F-5Es.

Throughout the 1980s and 1990s Top Gun, VF-43 and VF-45 swapped out aircraft more than once in an attempt to provide realistic and useful dissimilar adversary

training. In 1987, Top Gun exchanged its Northrop F-5Es Tiger II for General Dynamics built F-16N Falcons in 1987.

In June of 1984, VF-45 "Blackbirds" based at NAS Key West took over the aircraft and responsibility of the VF-171 detachment and became a full-fledged aggressor unit on October 1, 1984. Their primary role was to provide DACT for the Atlantic Fleet's attack squadrons. In 1987, VF-45 acquired F-16Ns and by 1989 had 12 of these aircraft along with 12 A-4 Skyhawks. In 1988, VF-45 added six F-16Ns to its inventory of adversary aircraft. During 1988 and 1989, VF-45 loaned six of its F-16Ns to VF-43. To counter the loss of some of its F-16Ns, F-5Es aircraft were added to VF-45 in December 1989. The F-5Es operated alongside A-4s, T-2s and F-16N until the F-16Ns were retired prematurely in December of 1994 due to fatigue problems. By November 1995, VF-45 was still operating seven F-5Es and two F-5Fs, although the squadron was scheduled to decommission in 1996. VFC-12 reservists flying F/A-18s would perform the role of East Coast aggressor training.

In 1985, VF-43 switched from F-5E Tigers to Israeli-supplied F-21A Kfirs. Since the F-21As were provided on a temporary loan, VF-43 switched back to F-5Es in 1989 when the F-21As were returned to Israel. These newly acquired F-5Es were obtained from the USAF, which was then running down its once-large fleet of Tiger IIs. VF-43 provided dissimilar aircraft training until it was deactivated in September of 1993, and turned over its responsibilities to VFC-12, a reserve squadron equipped with the F/A-18.

As a result of budget cuts, the once sizeable fleet of Navy aggressor aircraft was cut down to virtually nothing. In February 1995, Top Gun's F-16Ns were placed in storage, leaving only F/A-18 Hornets and F-14 Tomcats. By the end of 1995, VFA-127 had 13 F-5Es and a single F-5F, but it too was scheduled for decommissioning in March of 1996. The burden of providing aggressor training rested with the Reserve Squadrons VFC-12 at Oceana and VFC-13 at Miramar.[4]

In 1994, VFC-12 (Fighting Omars) transitioned to the F/A-18 "Hornet" and assumed the leadership role for the successful transition to an all Reserve Navy

[4] http://home.att.net/~jbaugher1/f5_28.html Northrop F-5E/F Tiger II for US Navy. January 2, 2000.

Adversary program. Although the twin engine supersonic "Hornet" fulfills both fighter and attack missions for the Navy, in VFC-12 they are distinctly painted to provide a realistic threat simulation and enhance dissimilar air combat training. Because of its maneuverability and superior weapons system, the "Hornet" makes an extremely lethal adversary capable of simulating the most sophisticated 4th generation threat aircraft. This ability distinguishes VFC-12 as the only dedicated 4th generation adversary squadron in the Navy today.[5]

In 1996, VFC-13 (Saints) moved from NAS Miramar, CA, to NAS Fallon, NV, and transitioned from 12 F/A-18 to 25 F-5 aircraft. This transition to the F-5 Tiger II adversary aircraft provided Active and Reserve Navy pilots with air-to-air combat training against 3rd generation combat aircraft at significant savings to the taxpayer. Recent estimates show that the F-5 can be operated at one third of what it costs to operate an F/A-18. Since the decommissioning of VFA-127 (Cylons), VFC-13 is the sole remaining west coast Navy aggressor unit.[6] Commander, Strike Fighter Wing Pacific and Commander, Strike Fighter Wing Atlantic jointly support VFC-13 at Naval Air Station, Fallon, Nevada. The squadron's mission is to provide adversary training for US Navy air wings, regular and reserve fighter and attack squadrons, in addition to US Air Force, and US Marine Corps and Canadian forces.

On February 14, 2001, Naval Air Systems Command awarded a $54 million firm fixed price (FFP) contract with one base year and six option years to Sikorsky Support Services Inc (SSS Inc.). This contract requires SSS Inc. to provide organizational, intermediate and limited depot level maintenance for Northrop-Grumman F-5 Tiger II fighter aircraft based at Naval Air Station Fallon, Nevada and Marine Corps Air Station, Yuma, Arizona. The US Navy's Composite Fighter Squadron-13 (VFC-13) and the US Marine Corps' Fighter Training Squadron (VMFT-401) fly the F-5 aircraft. SSS Inc. is responsible for providing the same administrative services and level of support to the aggressor squadrons as provided by a military squadron. The contractor performs all

5 http://www.globalsecurity.org/military/agency/navy/vfc-12.htm Pike, John. Fighter Squadron Composite Twelve (VFC-12). December 31, 2002.

6 http://www.fas.org/man/dod-101/sys/ac/f-5.htm Military Analysis Network. F-5 Freedom Fighter/Tiger. December 27, 1999.

corrective, organizational, intermediate and limited depot level maintenance under a firm fixed price contract. Maintenance actions involving purchase of direct parts, repair parts, and materials not available in the supply system are not covered by a fixed price agreement and are performed on a cost reimbursable basis. In addition, SSS Inc. is required to provide transient line functions, which include aircraft fireguard, directing, parking, securing, and assisting flight crews for transient Tactical Air Warfare Program aircraft. When aircraft are deployed to other USN, USMC, or USAF bases for training, contract personnel will deploy with the aircraft and are responsible for on-aircraft servicing, maintenance and additional maintenance support for the aircraft.

Today, aggressor squadrons are tasked with the mission to provide adversary training for US Navy pilots. In addition, they are challenged with increasing mission requirements, limited funding and limited choice of aircraft platforms to provide adversary training. Funding is a significant factor affecting adversary training. The US Navy is seeking methods to provide beneficial training at reduced costs to the warfighter. By retiring aircraft from active service, this effort not only frees up funding, but also presents an opportunity for aggressor squadrons to upgrade the quality of training offered. The F-5E/F was selected for use as aggressor aircraft because of the similarity in size and performance to MiG-21 aircraft. Furthermore, the cost per flight hour was significantly lower than any other tactical aircraft in military service. F-5E/F aircraft are slated to remain in service until 2014. To date, no replacement aircraft have been identified. The single seat F/A-18A and dual seat F/A-18B Hornets, which have been in service since 1983, have been selected for retirement starting in 2003. By 2007, 65 F/A-18A and 5 F/A-18B aircraft will be retired.[7] Table 1 displays the projected F/A-18A/B aircraft retirement schedule through 2012.

	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
FA-18A	192	140	140	129	127	127	127	114	92	58
FA-18B	33	33	33	28	28	28	28	23	23	23

Table 1. Projected F/A-18 Aircraft Retirement

[7] USNavy Aircraft Inventory Budget Exhibit A-II, Office of the Chief of Naval Aviation, Director Air Warfare (N78), 2003

Proponents of the F/A-18A/B aircraft believe that the F/A-18A/B aircraft is a more suitable platform to conduct adversary training. They favor the F/A-18A/B's 4th generation pulse-doppler radar capabilities over the F-5E/F pulse radar. The quality of the training is determined by the type of aircraft the adversary aircraft are able to simulate based on performance characteristics such as radar type. Proponents of the F-5E/F aircraft favor the cost efficiencies of the F-5E/F aircraft over the F/A-18A/B. Almost concurrent with the retirement of the F/A-18A/B aircraft in 2007, NAVAIR's current F-5E/F maintenance contract will expire in February 2008, leaving the option open to assess the suitability of either the F-5E/F or the F/A-18A/B as the platform to continue conducting adversary training for US Navy pilots.

Should the US Navy continue to use the F-5E/F aircraft to conduct adversary training, or should it switch to the F/A-18A/B? The cost of using the F-5E/F or the F/A-18A/B aircraft to conduct the VFC-13 mission of adversary training for US Navy pilots is the focus of our study.

II. METHODOLOGY

This section presents the methodology, including data collection, definition and assumptions associated with the CBA of F-5 replacement and contract maintenance. It further identifies the steps of the CBA including the following: (1) specify the set of alternative projects, (2) decide whose benefits and costs count, (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 the net present value of each alternative, (8) perform sensitivity analysis, and (9) make a recommendation based upon the net present value and sensitivity analysis.

Three alternatives are analyzed in this CBA. The first alternative involves continuing to operate the F-5E/F Tiger aircraft with contractor-supported maintenance by awarding another F-5E/F maintenance contract when the current F-5E/F maintenance contract expires on February 11, 2008. The second alternative involves replacing the F-5E/F with the F/A-18A/B when the current F-5E/F maintenance contract expires in 2008. The third alternative involves installation of a 4^{th} generation pulse-doppler radar in the F-5E/F aircraft by 2008 and awarding another F-5E/F maintenance contract when the current F-5E/F maintenance contract expires in 2008.

Several assumptions are made with regard to all three alternatives. First, retired aircraft including the F-5 and the F/A-18 would be placed into storage at the Air Force's Aerospace Maintenance and Regeneration Center located at David-Monthan Air Force Base in Tucson Arizona or sold via the Foreign Military Sales program. A second assumption is that NAVAIR will continue to use contractor-supported maintenance to support the aggressor squadrons. Third, we assume that adequate competition for maintenance contracts still exists. The contracting officer for NAVAIR determined in 2000 there was adequate competition, four bidders, for the contractor-supported maintenance contract. Therefore, future contract prices will be relatively the same price

as the existing F-5 maintenance contract.[8] Fourth, analyzing three major cost components, which make up the Navy's Flying Hour Program, are sufficient to estimate flying hour costs. Fifth, government furnished infrastructure assets were not analyzed as they are common costs incurred by the maintenance activity selected, contractor or organic, per the specific T/M/S aircraft. Finally, when calculating NPV, 12 years will be analyzed for this CBA (FY2003-2014) due to the remaining projected 12-year service life of the F-5E/F. Assumptions specific to each alternative follows.

1. Alternative One

First, the maintenance cost for maintaining aging aircraft will continue to increase. Second, the mission for the F-5E/F is to simulate 3rd generation combat aircraft such as the MiG-21 which may be flown by an adversary in combat. Third, the 32 F-5E/F aircraft purchased from Switzerland in 2002 and are being refurbished by Northrop-Grumman will have lower maintenance costs than the current aircraft in operation with 6000+ flight hours.[9] Finally, current F-5E/F aircraft will be used as spares to support the newly acquired F-5E/F aircraft.

2. Alternative Two

First, spare parts for the F/A 18 A/B are available and will continue to be available in the supply system. Second, excess F/A-18A/B aircraft once retired will be used for spare parts and not sold through the FMS program or scrapped. Third, F/A-18A/B retirement is still on schedule. Fourth, the F/A-18 A/B aircraft when retired will be fully mission capable. Fifth, replacing the F-5E/F aircraft with the F/A-18A/B aircraft prior to its retirement date is not feasible due to the most degraded F/A-18A/B's will be retired first, thus making these unfit aircraft available to replace the F-5E/F. Finally, the contractor performed maintenance contract will continue until completion in 2008.

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[8] Bolles, Jay C. NAVAIR PMA225V2. Telephone interview with LT Jesse Porter, NPS, Monterey, California, October 20, 2003

[9] Sirak, Michael. Iraq war delays edelivery of Swiss F-5Es to US Navy. Jane's Defence Weekly, April 30, 2003.

3. Alternative Three

First, the maintenance cost for maintaining aging aircraft will continue to increase. Second, the mission for the F-5E/F is to simulate 4th generation combat aircraft such as the MiG-29 and Su-27 which may be flown by an adversary in combat. Third, the 32 F-5E/F aircraft purchased from Switzerland in 2002 and are being refurbished by Northrop-Grumman will have lower maintenance costs than the current aircraft in operation with 6000+ flight hours. Finally, current F-5E/F aircraft will be used as spares to support the newly acquired F-5E/F aircraft.

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III. IDENTIFY SET OF ALTERNATIVE PROJECTS

Step 1 of a CBA requires the analyst to specify the set of alternative projects. [10] There are three alternatives analyzed which will be presented in this CBA.

a. The first alternative involves continuing to operate the F-5E/F aircraft with contractor supported maintenance. Each of the six option years on the contract would be awarded. After the sixth option has been awarded, a new solicitation would be made by NAVAIR for contractor-supported maintenance.

b. The second alternative involves replacing the F-5E/F with the F/A-18A/B aircraft in 2008. This alternative continues to operate the F-5E/F aircraft with contractor-supported maintenance until 2008. Once the last option of the contract is complete, the F-5E/F aircraft would be replaced by F/A-18A/B. By 2008, 63 F/A-18A and five F/A-18B models will have been retired from the fleet. A new solicitation would be made by NAVAIR for contractor-supported maintenance for the F/A-18A/B.

c. The third alternative involves installation of a 4^{th} generation pulse-doppler radar in the F-5E/F aircraft by 2008 and awarding another F-5E/F maintenance contract when the current F-5E/F maintenance contract expires in 2008.

By allowing the current F-5 maintenance contract to expire in 2008 for all three alternatives analyzed, the government avoids paying termination costs, which would occur if the government terminated the contract during an option year. With this alternative, NAVAIR has the option to solicit a new contractor-supported maintenance contract or modify the existing contract for F/A-18A/B support prior to the F/A-18A/B assuming the aggressor mission with contractor supported-maintenance.

[10] Boardman, Anthony, et al. Cost-Benefit Analysis: *Concepts and Practice*, *Second Edition*. New Jersey: Prentice Hall, 2001.

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IV. DECIDE WHOSE BENEFITS AND COSTS COUNT

A. KEY PLAYERS

Step 2 of a CBA requires the analyst to decide who has standing and whose benefits and costs should be counted.[11] A stakeholder analysis is an effective tool to accomplish this task. A stakeholder analysis is the initial step in building the relationships needed for the success of a participatory change, initiative, or policy. It also aids in assessing the external environment in which the implementation of changes will take place. The analysis should center on which alternative of the CBA represents the stakeholders' ability to influence an alternative. The stakeholders' ability to influence an alternative can be defined as the ability to influence a decision based on whether the stakeholder 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. Table 2 provides a summary of key stakeholders and their potential to influence the choice of alternatives analyzed in this CBA.

Stakeholder	Influence on the Alternatives
Fighter Squadron Composite 13	Medium
CNAR	High
NAVAIR	High
Congress	High
Contractors	Low

Table 2. Stakeholder Analysis[12]

[11] Boardman, Anthony, et al. Cost-Benefit Analysis: *Concepts and Practice, Second Edition*. New Jersey: Prentice Hall, 2001.

[12] Brydsong, Ricardo John et al. "Transformation of DOD Contract Closeout": Appendix B. MBA Professional Report. Monterey, California: Naval Postgraduate School, June 2003.

B. KEY STAKEHOLDERS

The mission of Fighter Squadron Composite 13 (VFC-13) is to provide quality adversary training for regular Navy fleet and replacement squadrons and air wings, reserve fighter and attack squadrons, USAF and USMC units, and Canadian forces.[13] The pilots of VFC-13 are stakeholders as they are the operators of the subject aircraft. The pilots provide an operational viewpoint of the costs and benefits of F-5E/F and F-18 A/B aircraft. As operators, they are not the primary decision makers who can implement the choice of alternatives of this CBA. However, as the primary operators, VFC-13 pilots have the potential to moderately influence the choice of alternatives.

Commander Naval Air Force Reserve (CNAR) is the senior type command (TYCOM) for all reserve aviation assets used by the United States Navy. CNAR provides operationally ready air squadrons and aircraft carriers to the fleet. They ensure that the reserve aviation fleet squadrons are trained and their aircraft are fit for action, backed up by a complex, relentless system of spare parts and maintenance that allows no compromise in safety or readiness.[14] As the TYCOM, CNAR is a stakeholder of the alternatives of this CBA. Many of the individuals within CNAR are former pilots who have flight experience and have assumed administrative duties for the TYCOM. They provide both an operational and administrative viewpoint when addressing costs and benefits of F-5E/F and F-18A/B aircraft. As administrators, they are frequently involved in major decision-making processes that CNAR has the potential to significantly influence such as the choice of alternatives for this CBA.[15]

The mission of Naval Air Systems Command (NAVAIR) is to serve the Warfighter by bringing technology to bear on behalf of defending the United States through Naval Aviation and wherever US Navy advanced technologies provide value. NAVAIR is driven to use Naval Aviation Technologies to solve the problems of modern

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[13] Fighter Squadron Composite 13 (VFC-13). Accessed November 13, 2003. http://www.fallon.navy.mil/VFC_13.HTM

[14] Commander Naval Air Forces Reserve. Accessed November 16, 2003. http://reserves.navy.mil/Reserves/Public/Staff/Centers/Air/WelcomeAboard/default.htm?LGUID={3FCAE1B7-D2B5-4A12-B94D-154A810F529E}

[15] Suggs, William LCDR. VFC-13, Operations Officer. Telephone interview with LCDR Rob DeGuzman. NPS, Monterey, California, November 14, 2003.

warfare and to create new capabilities that strengthen our nation's position within it.[16] As the Naval Air Systems Command for the US Navy, NAVAIR is a stakeholder and primary decision maker for the Navy concerning Naval Aviation. Hence, NAVAIR has the potential to significantly influence on the choice of alternatives of this CBA.[17]

As 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 of this CBA. The current NAVAIR F-5E/F (VFC-13) and F/A-18A/B (NSWAC) maintenance contracts had several responsive and responsible bidders. Market research by NAVAIR indicates there will still be several responsible and responsive contractors to perform maintenance for either the F-5E/F or F/A-18A/B aircraft when the existing F-5E/F maintenance contract expires in 2008.[18] Hence, in a near perfect competitive market where sellers have minimal influence over buyers because there are several sellers to select from, contractors have the potential to minimally influence the choice of alternatives in this CBA.

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[16] About NAVAIR. Accessed November 16, 2003. http://www.navair.navy.mil/index.cfm?fuseaction=about.default

[17] Bolles, Jay C. NAVAIR PMA225V2. Telephone interview with LT Jesse Porter, NPS, Monterey, California, October 20, 2003

[18] Bolles, Jay. C. NAVAIR PMA225V2. Telephone interview with LT Jesse Porter, NPS, Monterey, California, October 27, 2003

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V. CATALOG IMPACTS AND SELECT MEASUREMENT INDICATORS

Step 3 of a CBA requires the analyst to list the physical impacts of the alternatives as benefits or costs and to specify the impacts' measurement units.[19] Impacts and measurement indicators for the three alternatives analyzed for this CBA are summarized in Table 3.

Impacts and Measurement Indicators	F-5E/F 2008	F/A-18A/B 2008	F-5E/F 2008 with 4th Generation Radar	Units of Measurement
Costs				
Fuel (FF)	Fuel costs obtained from VAMOSC	Fuel costs obtained from VAMOSC	Fuel costs obtained from VAMOSC	Dollars
AVDLR (FA)	AVDLR costs obtained from VAMOSC	AVDLR costs obtained from VAMOSC	AVDLR costs obtained from VAMOSC	Dollars
Maintenance Consumables (FM)	Consumable costs obtained from VAMOSC	Consumable costs obtained from VAMOSC	Consumable costs obtained from VAMOSC	Dollars
Contract Maintenance (FW)	Contract labor costs obtained from VAMOSC	Contract labor costs obtained from VAMOSC	Contract labor costs obtained from VAMOSC	Dollars
Contract Admin	Contract closeout & contract solicitation costs	Contract closeout & contract solicitation costs	Contract closeout & contract solicitation costs	Dollars
Training	Existing 3rd generation radar capabilities; cost $0	Existing 4th generation radar capabilities; cost $0	Lacking 4th generation radar capabilities; $34.5 million installation cost	Dollars
Benefits				
Training	Simulates lower threat aircraft	Simulates higher threat aircraft	Simulates higher threat aircraft	Qualitative Impact

[19] Boardman, Anthony, et al. Cost-Benefit Analysis: *Concepts and Practice, Second Edition*. New Jersey: Prentice Hall, 2001.

Safety	1 severe hazard; 2 routine hazards	65 severe hazard; 193 routine hazards	1 severe hazard; 2 routine hazards	Hazards avoided converted to dollars
T/M/S Retirement	F-5E/F retirement more beneficial than F/A-18A/B retirement	F-5E/F retirement more beneficial than F/A-18A/B retirement	F-5E/F retirement more beneficial than F/A-18A/B retirement	Qualitative Impact
Readiness	Dedicated parts support	Competes with F/A-18 C/D's and E/F's	Dedicated parts support	Qualitative Impact

Table 3. Impacts and Units of Measurement Indicators

A. FLYING HOUR PROGRAM

The Department of the Navy (DON) Operations and Maintenance (Active) and Operations and Maintenance (O&M) (Reserve) appropriations include billions of dollars each fiscal year for the Flying Hour Program (FHP) under the Air Operations portion. The FHP includes flight hours for both the Navy and the Marine Corps. These funds are divided among four major claimants (CINCLANTFLT, CINCPACFLT, CINCUSNAVEUR, and COMNAVRESFOR). The funds are used primarily to pay for fuel, repair parts, maintenance labor, and miscellaneous associated costs such as Temporary Duty (TAD). The Navy and Marine Corps use the FHP to support day-to-day flight operations and maintenance associated with Naval aviation.

The budgetary elements, grouped by Aviation Fleet Maintenance, (OFC-50) have direct impact on determining the cost per flying hour for each type of aircraft. This CBA will focus on the following key budgetary cost elements: Fuel (FF), Maintenance Consumables (FM), Contract Maintenance (FW), and Aviation Depot Level Repairables (FA), Costs. These FHP direct flight hour costs (FF, FA, FW/FM) will be the focus of this CBA as these are the most significant costs of the FHP. In accordance with OFC-50, Maintenance and Contract costs will be grouped together as one category of direct costs titled Maintenance/Contract (FM/FW) costs for analysis purposes of this CBA.

The Visibility and Management of Operating and Support Cost (VAMOSC) system provides Operating and Support (O&S) flying hour costs for the FHP, including all aspects of Naval Aviation from high-level aggregate reports to detailed reports on

individual systems during specific time periods. The VAMOSC program was used to obtain actual annual costs incurred given the number of flight hours by both the F-5E/F and F/A-18A/B aircraft types during FY02. A VAMOSC extract of the flying hour programs direct costs (FF, FA, FW/FM) are included in appendix B. For the purpose of this CBA, Navy aircraft, flight hours and costs were used to make comparisons between platforms. To gain a better appreciation of the Navy's FHP and the direct flight hour costs elements which feed the VAMOSC system, a brief overview of the FHP process is warranted.

1. Overview

As a brief overview of the FHP process, the Assistant Chief of Naval Operations (CNO) for Air Warfare (N-78) is responsible for formulating the annual funding required for each aircraft type/model/series (T/M/S). The primary budget tool utilized is the Operational Plan (OP-20). Throughout the year, the N-78 staff works closely with their counterparts at the major claimant level, such as Commander in Chief, Pacific Fleet (CINCPACFLT) and their Air Type Commander (TYCOM) CNAR, to monitor FHs flown. The TYCOM then distributes quarterly grants to each squadron under his command based on the upcoming requirements. On a monthly basis, fiscal year to date (FYTD) feedback from the squadrons executing the FHP are collected, analyzed, and fed back up the chain of command to assess how costs for Fuel, AVDLRs, and Contracts/Maintenance are tracking relative to the OP-20. The TYCOM then certifies the obligations and these figures are used to cost out the year's requirements at the end of the fiscal year. Furthermore, other variables, such as an inflation factor, an aircraft-aging factor, and other program change factors are added into the cost calculation. These data points are also used to justify future annual funding requirements. Naval Aviation is programmed, budgeted, and funded to fly approximately 1.2 million hours each year. This number does not include undergraduate flight training or Research, Development Test and Evaluation flight hour requirements. The FHP provides resources for Navy and Marine aviation forces to, train in prescribed readiness areas, perform flights in support of required maintenance/logistics efforts, conduct routine deployed operations, and conduct warfare and warfare support operations.

2. Flight Hours

The source documents for the basic FHP calculation of hours are: Training and Readiness Matrix (CNAF), Marine Aviation Campaign Plan (HQMC APP), Aircraft Program Data File (N780G), Required Operational Capability/Potential Operational Environment, Documents (N780 ROs), and direct fleet input for Fleet Air Support and the Reserves.

3. Flight Hour Costs

Both direct and indirect costs are calculated for the FHP. Direct costs include fuel, AVDLRs, and contracts/maintenance (contract maintenance and maintenance consumables) costs. Fuel costs are incurred by the Navy in order to provide JP-8 jet fuel at the price established by the Defense Energy Supply Center. The Navy Petroleum Office sets the expenditure price for all Navy and Marine Corps activities to report fuel usage. AVDLR costs for the CBA include AVDLR cost of goods, AVDLR cost recovery, Commercial Aircraft Rework and Commercial Aircraft Engine Rework. Contract costs include contractor logistics support, intermediate level civilian and contractor support. Maintenance consumables costs include the costs of the maintenance consumable repair part. Indirect costs include squadron TAD, fleet simulator support, Transportation of equipment (TOT), Commercial Air Services, NMCI and various other costs. They are not part of the OP-20, but are budgeted under special interest code FO. Indirect flight hour costs are not included in this CBA as they are not as significant of a cost as the FHP direct costs are.

4. Cost per Hour

Direct costs are calculated on a cost per hour basis. The baseline for each budget is the last complete year of certified fleet costs. The baseline is escalated across the Fiscal Year Defense Plan using Working Capital Fund rates to accommodate the changing cost of spare parts to the fleet. AVDLR costs are further adjusted for the anticipated change in demand using a Center for Naval Analysis (CNA) formula developed during a recent aging aircraft study. AVDLRs and maintenance consumables are further adjusted for additional planned growth as identified by NAVAIR/NAVICP-P using the Cost Adjustment and Visibility Tracking System (CAVTS). Likewise, AVDLRs and maintenance consumables are adjusted for anticipated savings due to a

variety of reliability improvements. Contract maintenance costs are provided by PMA-207 in support of G-12s, G-20s, G-9s, UC-35s, G-40s, G-26s, and Adversary (F-5s/F-16s)[20].

B. MAINTENANCE CONTRACT ISSUES

The current F-5E/F maintenance contract is a fixed price, award-option incentive type contract with one base year and six option years. In order to adequately analyze the three alternative options involved in this CBA, a comprehensive understanding of pertinent contracting issues and cost associated with each alternative is required. Alternative one of continuing the status quo with the F-5E/F maintenance contract entails to continue awarding each option and reissuing an F-5E/F contract solicitation for full and open competition at the end of the life of the contract in 2008. Alternative two of replacing the F-5E/F with the retired F/A-18A/B by 2008 also entails to continue award of each F-5E/F award option until the end of contract life, but issues a new contract solicitation for full and open competition for the replacement F/A-18A/B aircraft. The third alternative of installing a 4th generation pulse-doppler radar in the F-5E/F's by 2008 reissues an F-5E/F contract solicitation for full and open competition at the end of the life of the contract in 2008. By waiting to reissue a new aircraft maintenance contract at the end of the current F-5E/F maintenance contract, all three alternatives mitigate risk and reduce cost by forgoing costly contract termination costs, contract claims, and disputes by the government unilaterally declining to award the next option year. Furthermore, all three alternatives also have contract closeout costs associated with the F-5E/F contract. In the context of this discussion, mitigating risk is defined as reducing and preventing excessive cost and cost creep.

The following section provides a background of the current F-5E/F maintenance contract, as well as discusses the various contract issues and risks involved with contract terminations, claims, disputes, appeals, contract closeouts, and contract solicitations. The following discussion provides a framework of determining which contract methods offer

[20] Fowler, A., *Flying Hour Program,* Paper used for annual updates. Alexandria, Virginia. August 12, 2003.

the least risk and cost, which ultimately led to our determination of our three alternative options for the F-5E/F and F/A-18A/B CBA.

1. F-5E/F Maintenance Contract

Program Manager Air 225 (PMA225) is delegated authority from and is ultimately responsible and accountable to the Commander, Naval Air Systems Command (COMNAVAIRSYSCOM). PMA225 has been tasked by COMNAVAIRSYSCOM to provide contract maintenance, logistics management, and administration in support of the F-5E/F SOW, which provides the concept, performance specifications, and requirements for that support. An abbreviated F-5E/F SOW has been provided as appendix C. The most important contractor performance criteria is to provide safe flyable aircraft to complete the Navy's daily flight schedule.

The services described in the F-5E/F SOW are performed in accordance with OPNAVINST 4790.2 series. The contractor provides and maintains organizational (O), intermediate (I), limited depot (D) level aircraft maintenance, management, logistics support services and other services as specified in the F-5E/F SOW for aircraft based at Fighter Composite Reserve Thirteen (VFC-13) Fallon NV, and Marine Fighter Squadron Training (VMFT-401) in Yuma AZ (approximately 32 F-5E, and 4 F-5F).

The Organizational, Intermediate, and limited Depot level aircraft maintenance the contractor provides includes associated support equipment, power plants, airframes, aviation life support systems, electronic and electrical instruments, armament radar/fire control and flight line services in order to meet the flying programs of each activity and its daily mission requirements. Organizational, Intermediate, and limited Depot level maintenance is maintenance which is performed at the site where the aircraft are permanently assigned or on temporary detachment. The contractor ensures that aircraft are maintained to achieve maximum utilization of all assets. The contractor is fully responsible for the correction of all damage and defects, which are directly attributed to the Contractor's performance or actions under the F-5E/F contract[21].

[21] Naval Tactical Air Warfare Aircraft Maintenance F-5 E/F Statement of Work Attachment 1, N00019-01-C-0109, 2001.

a. Award-Option Incentive Contract

The current F-5E/F maintenance contract is an award option incentive, fixed-priced contract. The award-option incentive is described in FAR 17.2. The award-option incentive is a unique contracting method in that it rewards the contractor by extending the contract without competition. Under an award-option incentive, a government team monitors and evaluates the contactor's performance against the performance standards of the contract and decides whether the contractor's performance was good enough to merit an extension through exercising the next award option year. The extension is conditioned upon the government's continuing need for the service and availability of funds.

A true award-option incentive rewards the contractor with a contract extension through an additional option. An award option is a unilateral right of the government, and a contractor is not entitled to the exercise of an option. The contractor bears the risk of not being awarded the next option year based on contractor performance issues, availability of funds, and the best interests of the government. If the contracting officer determines that it is in the best interest of the government to not award the next option year, the contracting officer does not have to terminate for convenience and can simply close the contract at the end of the base or option years.

Agencies have used award-option incentives when acquiring a variety of services. The incentive has been used with several different pricing and delivery arrangements such as fixed-price as in the case of the current F-5E/F maintenance contract, cost-reimbursement, indefinite-delivery/indefinite quantity, and requirements.

The award-option incentive may provide a solution to one of the most vexing shortcomings of contractual incentives; they do not work as advertised. The contractual incentives described in FAR Part 16 are all profit incentives by rewarding excellent performance by paying more money. However, since the early 1960's, researchers have concluded that such profit incentives do not produce the results predicted by incentive theory. If the researchers are correct and contractual incentives have had little effect on contract performance, then the award-option incentive is a promising development. The award-option incentive rewards a contractor with additional

business, which satisfies four of the long-term goals identified by the Logistics Management Institute in a 1968 study: (1) enhanced company image and reputation, (2) increased future business, (3) retention of skilled personnel, and (4) the maintenance of an allocation base for fixed costs. The award-option incentive gives a contractor a chance to earn a more all-encompassing reward than short term profit dollars by rewarding a long-term business relationship.

Aside from the potential for motivating contractors to perform excellently, there are at least three other advantages to using award-option incentives to establish long-term business relationships. These include increased operational efficiency and effectiveness, inc4reased contractor investment, and reduced acquisition transaction costs. A potential disadvantage of a long-term business relationship is the possibility that the agents of the contracting parties will begin to conduct business on a personal basis instead of a proper professional basis. People who have come to know and like one another in the course of time may relax their standards and overlook performance deficiencies for the sake of their personal relations[22].

2. Contract Termination

A contracting officer has the authority to terminate a contract by either a termination for convenience (T4C) or a termination for default (T4D). FAR Part 49 grants the authority and responsibility to contracting officers to terminate contracts in whole or in part for the convenience of the government or for default, defines the duties of the contractor and the contracting officer, and establishes general procedures for the settlement of terminated contracts and settlement agreements. After issuing a notice of termination, the contracting officer is responsible for negotiating any settlement with the contractor, including a no cost settlement if appropriate. Hence, contract terminations can be a costly decision for the government and should be exercised only if it is in the best interest of the government.

A T4C provides the government the ability to terminate a contract in whole or part that is made obsolete or is no longer in the best interest of the government. A T4C is

[22] Edwards, Vernon J. Award-Term: The newest Incentive. Contract Management, February 2001.

not a normal commercial business practice and is unique to government contracting. The governments right to terminate for convenience is based upon inclusion of the termination clause (FAR part 52.249) and agreement amongst parties, by operation of law, by cancellation of a contract, and also by breach of contract in the event an improper termination for default occurs. Under a termination for convenience, the government agrees to make the contractor whole by reimbursing all reasonable and allocable costs incurred for performance up to the time of termination, certain continuing costs (post termination), settlement expenses, and under fixed price contracts, maintaining the same profit level on work performed up to the termination for convenience decision unless the contractor would have incurred a loss. Furthermore, the contractor is not allowed profit on settlement expenses nor is the contractor entitled to anticipatory profits.

The other type of termination is a T4D. The government has a right to terminate for default if the contractor fails to deliver the contract supplies or perform the services on time, to make progress so as to endanger performance on the contract, or to perform any of the other provisions of the contract. Usually the contracting officer issues a cure notice allowing a contractor to fix the termination for default deficiencies.

After issuing a notice of termination, the contracting officer is responsible for negotiating any settlement with the contractor, including a no-cost settlement if appropriate. Auditors and contracting officers promptly schedule and complete audit reviews and negotiations, giving particular attention to the need for timely action on all settlements involving small business concerns. For the F-5E/F maintenance contract, the decision to exercise the unilateral right to terminate for convenience may bear some cost to the government and will most likely lead to contractor claims and disputes. Fortunately, the F-5E/F maintenance contract contains award-option incentives, which allows the government to forgo potential costs associated with termination for convenience by simply opting to not award the next option year. Yet, the unilateral decision to not award the next option year can only occur at the end of a given option year[23].

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[23] Yoder, CDR E. Cory. MN3315 Acquisition Management and Contract Administration Course Slides. Monterey, California: Naval Postgraduate School, 2002-2003.

3. Claims Management

If the government elects to terminate for convenience or if the contract is in breach of contract and the government has no recourse but to terminate for default, then the contracting officer must negotiate settlement costs for work performed up to the time of contract termination. If the contractor disagrees with the contracting officer's proposal for negotiating the termination for convenience settlement, then dispute proceedings commence. There are four methods to resolving claims: direct negotiation, alternative dispute resolution (ADR), issuing a COFD, and the appellate process.

a. Alternative Dispute Resolution

FAR Part 33 encourages the contracting officer to use of ADR to the maximum extent practical, except in cases of fraud, penalties or forfeiture. ADR techniques involve conciliation, facilitation, mediation, partnering, fact-finding, mini-trial, and arbitration. When using ADR, the contractor is required to certify all claims regardless of amount. Also, contracting officers and contractors must provide written explanations if they reject the other parties' request for ADR procedures.

b. Disputes & Contracting Officer's Final Decision

The contracting officer serves in a dual capacity in the dispute process: he is the government's advocate in conducting negotiations with the contractor, and he is a quasi-judicial official when rendering the final decision under the disputes clause. Furthermore, it should be the contracting officer's priority to dispose of dispute matters through negotiated settlements that bind the parties. Negotiated settlements are always the preferred method, and it is the government's policy to settle all claims by mutual agreement at the contracting officer's level, without litigation for the following reasons: saves time and money, precludes extensive personnel involvement, preserves conciliatory partnership, and often achieves the same end state. If the two parties cannot come to a negotiated, binding settlement, the contracting officer must issue his contracting officer's final decision (COFD).

The COFD serves two functions: it is the final settlement offer of the government, and it is a prerequisite to the contractor's use of adjudication under the contract disputes act. After the COFD, the contractor has the right to appeal the COFD to

the Armed Services Board of Contract Appeals (ASBCA) or to the court of federal claims (CFC). ADR after COFD does not constitute a reconsideration of the final decision. Timing is crucial as statutory limits are placed on both the contracting officer and the contractor for submission and disposition. COFD is the first step in the litigation process. The statute requires that contracting officer issue a COFD on claims of $100K or less within 60 days from receipt of a written request but can be deferred if negotiations are being conducted. Similarly, the contracting officer shall, within 60 days of receipt of a submitted, certified claim over $100K, issue a decision or notify the contractor of the time within which a decision will be issued. The decision of a contracting officer shall be issued within a reasonable time, taking into account such factors as size and complexity of the claim and adequacy of information. If the contracting officer does not issue a timely decision, the contractor has two alternatives: request ASBCA or CFC to order the contracting officer to make a decision, or process the case as an appeal against failure to make a decision. Courts have held that any failure by the contracting officer to issue a decision within the period required would be deemed to be a decision by the contracting officer denying the claim and will authorize the commencement of the appeal.

c. Appeals

The contractor must file in writing a notice of appeal within 90 days after receipt of a valid COFD. The appeal must express discontent with the final decision; state an intention to seek review by higher authority; identify the contracting officer, agency, or department location; contain contract number and description of requirements; and state the decision from which relief is sought. Upon receipt of an appeal, the contracting officer should contact legal and have a trial by attorney assigned, begin to assemble the appeal "rule four file", and continue to finance ongoing performance in the contract. Furthermore, within 30 days from receipt of the complaint, the contracting officer should file an answer to the appeal with the ASBCA denying the allegations completely, deny in part, claim lack of information to form belief, and/or reply that allegations are legal conclusions rather than statement of fact. Regardless, the contractor

must continue performance and comply with the COFD pending final decision on appeal.[24]

When the government is faced with the option to terminate the F-5E/F contract before the end of the negotiated option years, the contracting officer must determine what is in the best interest for the government, namely to mitigate risk. Fortunately, the government can forgo the costs associated with contractor claims, disputes and appeals by not terminating for convenience and instead elect to not award the next option year for the contract. The contractor does not have a legal recourse to support a claim or dispute due to the legalities and very nature of award-option incentive contracts. The contractor takes the risk of not being awarded follow on option years of an award-option incentive contract when they initially agree to perform services for the government. In this case, the contract simply ends and contract closeout procedures occur.

4. Contract Closeout

Contract closeout occurs when the procurement contracting officer signs the DD Form 1594 contract completion record or any other prescribed completion statement. Several areas must be considered when closing a contract: disposition of government property, reconciliation of unliquidated damages, establishment of final billing rates, and patent reports. Contrary to popular belief, contract closeout does not have to be the dregs of the acquisition cycle. In fact, timely closeout can mean real-time dollar savings to the organization and a wealth of satisfaction in shipping the files off to their final resting place. It is also a myth that closeout begins with physical completion of the contract. Contract closeout actually begins during acquisition planning. How well it is managed at that stage in the process makes a significant difference in the difficulty of the individual contract closeout steps. In practice, closeout is managed two very different ways. The first is proactive, planning ahead for the tasks and documentation, which will be part of the closure process. The second is more common, old dogs with missing or moth-eaten

[24] Yoder, CDR E. Cory. MN3315 Acquisition Management and Contract Administration Course Slides. Monterey, California: Naval Postgraduate School, 2002-2003.

records and the retirement 12 months earlier of everyone even remotely connected with the contract action.

Contract closeout usually follows DD Form 1597, contract closeout checklist. All contracts for closeout must meet the condition that the contract be physically complete in that the government must have inspected and accepted all deliverables, all options if any have expired, or a notice of complete contract termination has been issued to the contractor. Often times, there are contract closeout obstacles to be that the contracting officer must overcome before proceeding. For instance, if final indirect cost rates are not determined, Defense Contract Audit Agency (DCAA) audit reports to verify rates are not complete, if outstanding or unresolved claims are present, or if costs associated with a termination settlement are not determined, then the government will not be able to readily closeout the contract.

Specific time frames for contract closeout are dependent upon contract type and dollar value. Firm-fixed price contracts not within the simplified acquisition procurement threshold require contract closeout within six months of receipt of physical completion and final payment or after a termination by the contracting officer is issued. Contracts with an indirect cost rate, such as cost type contracts, require contract closeout within thirty-six months in which the contracting officer receives evidence of physical completion or a termination for convenience is issued. All other contracts require contract closeout within twenty months from receipt of evidence of physical completion[25].

5. Contract Solicitation

As for the F-5E/F maintenance contract, after the end of performance of a contract and contract closeout procedures thus commence, contract solicitation procedures occur for the new maintenance contract. As stated previously, all three alternatives of this CBA involve solicitation costs for issuing either a new F-5E/F or F/A-18A/B maintenance contract. Risks for each alternative involve the contract solicitation costs as well as the costs of actual contract performance. When issuing a new F-5E/F or F/A-18A/B

[25] Yoder, CDR E. Cory. MN3315 Acquisition Management and Contract Administration Course Slides. Monterey, California: Naval Postgraduate School, 2002-2003.

maintenance contract, mitigating risk during the post-award phase can be effectively accomplished by following the correct procedures during the pre-award phase. Several of these actions are listed in the FAR, others are listed through best business practices and experience. The key to success is locked in the beginning during the development of the Source Selection Process and the formation of the Integrated Product Team (IPT), including the Program Manager and Contract Manager. The Source Selection Process involves forecasting the steps to be taken during the acquisition process; conducting careful and thorough market research; defining requirements and developing the request for proposal (RFP); communicating requirements through publishing the RFP; developing proposal factors and evaluating proposals; source selection; and finally award.

a. Acquisition Planning

Proper acquisition planning for both the F-5E/F and F/A-18A/B maintenance contracts is integral in ensuring risk mitigation during the post-award phase. FAR Part 7 states that acquisition planning is the process by which the efforts of all personnel responsible for an acquisition are coordinated and integrated through a comprehensive plan for fulfilling the agency need in a timely manner and at a reasonable cost. Acquisition planning is important in mitigating risk during the post-award phase in that it makes good business sense: it coordinates efforts of IPT members, builds commitment of members, uncovers pitfalls, ensures realistic timeframes link actions required with specific milestones and times, and communicates approach.

Forecasting contracting steps such as plans, budgets, and schedules is an essential part of acquisition planning and reducing risk during the post-award phase for the following reasons: integral to the integrated process team; helps develop realistic plans, budgets, and schedules; helps develop long rage strategies; may recommend contract bundling; incorporates lessons learned from previous acquisitions; ensures acquisition milestones are established and adhered to; and conducts market research.

b. Market Research

The first step in source selection planning for both the F-5E/F and F/A-18A/B maintenance contracts is for the IPT to conduct thorough and exhaustive market

research. Market Research is defined as a process used to collect, organize, maintain, analyze and present data for the purpose of maximizing the capabilities, technology, and competitive forces of the market place to meet an organizations needs for supplies and services. In order to mitigate risk during the post-award phase, market research should be accomplished not only in the beginning of but also throughout the entire acquisition process. By performing market research throughout the entire contracting pre and post-award phase, the contracting officer will be kept current on factors that can directly impact the contract. In fact, market surveillance, a subset of market research, is defined as continuing market research to determine availability of products, reliability of sources, extent of competition, range of product characteristics, market acceptability, price trends, current market prices, and availability of distribution systems.

FAR Part 10 states that market research is mandatory, and further states that agencies must conduct market research before developing new requirements documents and before soliciting offers for acquisitions above the simplified threshold, or below, if adequate information is not available and the cost is justified. Also, FAR Part 12 states that market research should be conducted to determine whether commercial items could meet the requirements of the product. Commercial items in themselves can greatly mitigate post-award phase risk by selecting an item that has been proven by the marketplace and usually includes warranties, thereby eliminating developmental costs and rework costs to the government.

Other important points of conducting market research to reduce risk during the post-award phase include getting intimately acquainted with the market the product or service applies to. In other words, it is beneficial to know the practices of those markets. In general, the contracting officer should; know the market's political and financial factors, capacities and capabilities, economic profiles, competition in the market place, substitutes and complements, longevity and sustainability, supportability and producibility, and determine the extent of supporting socio-economic programs. Becoming well acquainted with these factors during the market research phase will arm the IPT with the correct knowledge of the requirements to be included in the solicitation,

the approximate amount of competitors who will become likely offerors, and the longevity and sustainability of the product or service.

c. Source Selection Plan

Conducting thorough source selection planning can greatly mitigate risk during the post-award phase for both the F-5E/F and F/A-18A/B maintenance contracts. The source selection plan specifies how the source selection activities will be organized, initiated, and conducted, provides a blueprint for conducting the source selection, determines the proposed pre-solicitation activities, and summarizes the acquisition strategy. The purpose of the source selection plan is to provide essential information to the contracting officer for development of RFP sections L and M of the solicitation, to serve as a written guide for conducting the evaluation and analysis of proposals for the source selection team, and to ensure that offerors are aware of how proposals will be evaluated and what information must be included in the proposals. Written guidelines for developing evaluation factors and conducting evaluations of proposals ensure that evaluation criteria do not change between the time the solicitation is released and the time offers are evaluated, thereby minimizing risk of protest during the post-award phase. Source selection plan goals to minimize risk during the acquisition phase include maximizing competition, minimizing the complexity of the solicitation, evaluation, selection decision, ensuring impartial evaluation, and ensuring selection of the proposal with the highest degree of realism.

d. Defining Requirements & RFP Development

The specifications of the RFP directly determine the extent of competition, procurement technique, and the contract type that can be used for both the F-5E/F and F/A-18A/B maintenance contracts. Specifications can be stated in terms of performance, functional, or design requirements. When performance specifications are used, the contractor bears most of the risk; when design specifications are used, the government bears most of the risk. Yet, when determining specifications to mitigate risk, the correct decision is to choose the type of specification that matches the nature of the need and the market available to satisfy such needs (versus arbitrarily choosing performance specifications to allocate more risk to the contractor when it is more appropriate to choose design specifications).

The following steps minimize risk when defining requirements for the purpose of providing feedback of the relevancy and realism of requirements and specifications: use IPTs early in the process; issue draft solicitations and RFPs; capitalize on industry conferences; conduct and use market research; conduct preproposal conferences; plan and execute a site visit; use commercial source standards; and use creativity and imagination. Use of these risk minimizing steps will encourage prospective offerors to evaluate and challenge all elements of the acquisition, propose methods to reduce proposal and contract costs, provide feedback on the proposed pricing arrangement, and identify requirements that account for a high percentage of the total cost.

e. Determining Contract Type

During the acquisition planning phase, the approach and methodology for determining the procurement contract type is established for both the F-5E/F and F/A-18A/B maintenance contracts. After conducting market research, developing the source selection plan, and clearly defining requirements, the contracting officer, with the approval of the Source Selection Authority (SSA) and the Source Selection Advisory Council (SSAC), determines the type of contract to be used for the product or service. Determining the correct contract type is based on several factors, including the requirements of the product and the maturity of the product or service to be procured. Also, understanding the functions and purpose of a contract for determining the correct contract type can mitigate risk during the post-award phase. The purpose of a contract is to provide five key functions: evidence of agreement, framework of accountability, risk allocation, payment function, and a motivation function. For mitigating risk purposes, risk allocation and motivation are the most significant. As the contract is a risk allocation device, risk can be allocated through cost, schedule and performance. Also, determining whether the contract will be fixed price (performance) or cost reimbursement (design) should be based on the requirements and the maturity of the product or service. Bottom line, the contract should be structured for mutual satisfaction between the government and contractor.

f. Communicating Requirements and Facilitating Competition

Publicizing the RFP through various media will directly enhance competition, thereby mitigating risk during the post-award phase for both the F-5E/F and F/A-18A/B maintenance contracts. FAR Part 5 states that contracting officers shall publicize proposed contract actions in order to increase competition, broaden industry participation, and assist small business concerns. Methods of publicizing include posting in FEDBIZOPS, public places, media announcements, trade journals, and various electronic bulletin board sources.

g. Evaluation Factors

An excellent method to provide fair and adequate competition and minimize protests for both the F-5E/F and F/A-18A/B maintenance contracts is to develop clear, distinct evaluation factors. A good rule of thumb is to have evaluation factors which are few in number, true discriminators with significant differences between proposals expected, consistent with the source selection plan, definable and measurable if quantitative or realistic if qualitative, predictive of a successful procurement, and tailored to the acquisition. When using the trade-off process, solicitations shall state whether evaluation factors other than cost or price are significantly more important, approximately equal to, or significant less important than cost or price. Developing the evaluation criteria is an iterative process that should involve all members of the IPT, including the contracting officer, program manager, and the SSAC and SSEB.

Determining the nature of the evaluation factors will reduce risk during the post-award phase. Despite FAR Part 15.605 stating that past performance, quality, and environmental issues shall be evaluated, considered, or addressed in every acquisition, it would be foolhardy not to. For instance, the government must record evaluations of contractor's past performance and make the information available to other agencies in order to improve the ability to predict quality of future work. Also, past performance evaluation criteria provide contractors with a powerful incentive to improve, thereby mitigating the risk of non-performance during the post-award phase. Furthermore, the evaluation factor of quality ensures the longevity and sustainability concept of a product or service, thereby mitigating risk. Finally, environmental factors

are considered when appropriate to ensure government compliance with environmental regulations, thereby minimizing risk of hefty fines during the post-award phase.

h. Proposal Evaluation

The proposal evaluation process for both the F-5E/F and F/A-18A/B maintenance contracts, if conducted properly, includes several steps that can mitigate risk during the post-award phase. The purpose of proposal evaluation is to assess the quality of each offer and determine the capability of the offeror to perform. The Source Selection Evaluation Board (SSEB), under the direction of the SSAC and the SSA, usually conducts the proposal evaluation. The first step is to have all SSEB members conduct pre-proposal training. Most SSEB members are technical experts of the product or service being acquisitioned and need comprehensive preproposal training to ensure the proposals are evaluated against the specifications (RFP Section C) and evaluation factors (RFP Section M) in a consistent and documented manner. Ground rules for proposal evaluation procedures include evaluating factors and subfactors by the same person, documenting each offerors strengths, weaknesses, deficiencies, and uncertainties against the factors and subfactors and not against other proposals, and ensuring consistency and fairness. These evaluations are summarized in a summary evaluation report that is forwarded to the SSAC and SSA along with the recommendation of contract award. Hence, using the evaluation factors, subfactors, and applicable evaluation standards will facilitate an equitable, impartial, and comprehensive evaluation against the solicitation requirements.[26]

i. Source Selection & Award

Mitigating the risk of not choosing the best value offeror or reducing the risk of protests from unsuccessful offerors can be accomplished by carefully following the FAR mandated procedures of the source selection and award phase for both the F-5E/F and F/A-18A/B maintenance contracts. After the SSEB conducts the proposal evaluation, either the SSA or SSAC will compare them to determine the proposal(s) that represent the best value based on the stated evaluation factors. In tradeoff acquisitions, the comparison process is complex and depending upon the evaluation factors, the SSA

[26] Yoder, CDR E. Cory. MN3315 Acquisition Management and Contract Administration Course Slides. Monterey, California: Naval Postgraduate School, 2002-2003.

may exercise a significant degree of judgment in selecting the successful offeror(s). While the SSEB evaluation ratings are merely labels, the SSA must not base his decision on these summary indicators. The SSA must base his decision on a detailed comparison of the strengths and weaknesses of the competing proposals. If the lowest-priced proposal is not the most superior in terms of non-cost factors, a tradeoff analysis is required. The SSA must make the source selection decision using rational and independent judgment based on a comparative analysis of the proposals. The analysis must be consistent with the evaluation factors and process described in the RFP and SSP. Beyond this, the SSA has broad discretion in making the source selection decision. The SSA may not rely on the evaluation ratings and scores alone. To determine which proposal provides the best value, the SSA must analyze the differences between competing proposals. This analysis must be based on the facts and circumstances of the specific acquisition. The SSA is not bound by the SSEB or SSAC's rankings or scores as long as the SSA has a rational basis for the differing opinions. Hence, mitigating risk during the post-award phase for the new F-5E/F or F/A-18A/B maintenance contract can be accomplished by carefully following the FAR mandated procedures of the source selection and award phase.[27]

6. F-5E/F & F/A-18A/B Contract Issues

Having discussed the various issues concerning contract termination, contract claims, and contract closeouts, there are two contract costs directly associated with all three alternative options of the CBA, contract closeout costs and contract solicitation costs. Taking the no cost award option versus the costly termination for convenience alternative involves only contract closeout costs upon the end of performance of the current F-5E/F maintenance contract. Also, all three alternative options of the CBA involve contract solicitation costs for either the F-5E/F or F/A-18A/B contract. Both SOWs for the F-5E/F maintenance contract at VFC-13 and F/A-18A/B maintenance contract at NSAWC, NAS Fallon Nevada, are included in appendices C and D respectively. Although both contract closeout costs and contract solicitation costs are

[27] Army Source Selection Guide. Assistant Secretary of the Army: Acquisition Logistics, and Technology, 2001.

direct costs associated with this CBA, because they are included in all three alternatives, they can be classified as irrelevant costs. Yet, irrelevant costs or not, these costs should still be considered when analyzing all costs of the three alternatives

a. T4C vs. Contract Expiration

For the F-5E/F maintenance contract currently performed in NAS Fallon, NV, a termination for convenience can take effect any given time by the government. The contracting officer at NAVAIR is required to provide at least thirty days notice to the contractor if the government elects to terminate for convenience. Termination for Convenience is not normally in the Government's best interest in a Firm Fixed Price environment. When a contractor loses a significant amount of business for any reason, there will be claims. For the F-5E/F Firm Fixed Price maintenance contract with award-option incentives, it would be better to not award the next option or wait until the end of the contract life in order to forgo potentially costly claims, disputes, and appeals. Hence, when faced with the decision to closeout a contract, NAVAIR's preference is to wait until the option year is complete and not award the next option or wait until the end of the contract life.[28]. By choosing this route, NAVAIR is faced with only contract closeout costs, thereby bypassing costly termination for convenience costs. All three alternatives involve contract closeout costs, which will be incurred at the end of the current F-5E/F maintenance contract life. Estimated contract closeout costs for the current F-5E/F maintenance contract, based on indirect salary costs, can be up to $1000.[29].

b. Contract Solicitation Issues

Both contracts for F-5E/F and F/A-18A/B maintenance are currently performed in NAS Fallon, NV. The Procurement Cycle Time (PCT) from requirements generation to contract award was approximately eight months. Both the F-5E/F and F/A-18A/B contract solicitations were administered at the same time. The contract solicitation could have been shorter by a few months, however, the contracting officer was required to perform a formal source selection, which requires several formal steps as

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[28] Bolles, Jay. C. NAVAIR PMA225V2. Telephone interview with LT Jesse Porter, NPS, Monterey, California, October 27, 2003.

[29] Contract Closeout Case Study. MN4371: Principles of Acquisition & Contracting Policy. NPS, Monterey, California, October 16, 2003.

outlined in previous sections. For both contracts, there was a single SSA, a SSAC made up of eight senior management officials, and a SSEB comprised of the leads of three evaluation teams, Past Performance, Price, and Technical Experience. The SSEB members compiled the evaluation from each team. The teams themselves were made up of about three to five personnel for each team who worked full time during the evaluation, totaling about twenty personnel. Both contract evaluations took about two weeks to perform, and NAVAIR's indirect salary costs to administer the solicitation of each contract were approximately $500,000. This contract solicitation cost is a one-time cost incurred after the end of performance of the current F-5E/F maintenance contract and equally affects all three alternatives. Hence, as far as contract solicitation alternatives are concerned, choosing to solicit an F-5E/F or F/A-18A/B maintenance contract has minimal impact on cost alternatives.[30]

C. TRAINING

When looking at a training viewpoint, the F-18A/B has 4th generation pulse-doppler radar capabilities, allowing the F/A-18A/B to simulate the higher threat aircraft such as the MiG-29, Su-27, and Su-30. This 4th generation pulse-doppler radar capability of the F/A-18A/B provides a significant benefit in Navy pilot adversary training compared to the F-5E/F, and the 4th generation radar capability is an essential component of alternative 2 and 3 of this CBA. The pulse-doppler radar emits an electronic signature, which makes the F/A-18A/B appear to be a MiG29, Su27, or other higher threat aircraft when conducting training missions. Furthermore, the F/A-18A/B's general performance capabilities enable it to simulate higher threat adversary aircraft. Hence, the F/A-18A/B's ability to simulate higher threat aircraft such as the MiG 29, Su-27, and Su-30 through its general performance characteristics is the benefit provided to the Navy.

On the other hand, the F-5E/F, without modification, has only a pulse radar. This pulse radar capability provides a benefit in Navy pilot adversary training. Yet, the pulse radar of the F-5E/F merely allows the aircraft to simulate a lower threat aircraft, such as the MiG-21, as opposed to a higher threat aircraft. The aggressor pilots are trained in

[30] Bolles, Jay C. NAVAIR PMA225V2. Email to LT Jesse Porter, NPS, Monterey, California, October 27, 2003.

Soviet tactics and use the F-5 to simulate MiG-21s for training US Navy pilots in aerial combat skills. Although there is a greater chance in encountering a MiG-21 than other higher threat aircraft as there are over 8,000 MiG-21's produced worldwide flown by over 40 countries per appendix E,[31] it is in the squadron's best interest to train to the higher threat aircraft. The approximate cost to purchase and install a 4th generation pulse radar on the F-5E/F is $1.5 million per aircraft.[32]

D. SAFETY

Aircraft hazard rate can provide a safety benefit by providing a difference in hazard rates between two aircraft. The difference in aircraft hazard rates will benefit the aircraft with the lower hazard rate.

Aviation safety data for both the F-5E/F and F/A-18A/B was retrieved from the Naval Safety Center Aviation Data and Analysis Division. The Aviation Data and Analysis Divisions sole purpose is to manage and retrieves aviation-safety data. The Aviation Data and Analysis Division collects and maintains this information in a database containing approximately 1,050 different characteristics stored in over 100 related database tables, with literally thousands of different encoded values. The F-5E/F and F/A-18A/B aviation safety data collected spanned the period from October 1999 thru October 2003. The aviation safety data was broken down to severe hazards where loss of life or serious hazard was likely and probable and routine hazards where minor injury was likely and probable. The F-5 had 1 severe hazard and 2 routine hazards where as the F/A-18A/B had 18 severe hazards and 38 routine hazards.[33]

Each class hazard can be divided by the number of aircraft in the US Naval inventory for which the hazard occurred in order to get a hazard per aircraft amount. The hazard per aircraft amount divided by the number of years for which the data was collected will provide a hazard per aircraft per year ratio. The difference in ratios for each aircraft will provide a safety benefit for the aircraft that provides the lesser amount

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[31] Global Aircraft. Accessed December 4, 2003. www.globalaircraft.org.

[32] Suggs, William LCDR. VFC-13, Operations Officer. Telephone interview with LCDR Rob DeGuzman. NPS, Monterey, California, November 14, 2003.

[33] Naval Safety Center Hazard Report Data. Updated October 23, 2003. http://www.safetycenter.navy.mil/aviation/aviationdata/hazrepdata.htm

of hazards. It is this safety factor for the F-5 aircraft, which provides the benefit for the F-5 alternative.

With 32 F-5E/F's and 201 F/A-18A/B's currently in US Naval inventory, the severe hazard rate is .69% per year for the F-5E/F and 8.08% per year for the F/A-18A/B, and the routine hazard rate is 1.39% per year for the F-5E/F and 24% per year for the F/A-18A/B. The F-5E/F has the lower hazard rate and will benefit with a 7.39% per year severe hazard benefit and a 22.61% per year routine hazard benefit over the F/A-18A/B. This means the F-5 has a 7.39% per year and 22.61% per year less likelier chance of experiencing a severe hazard and routine hazard, respectively, than the F/A-18A/B.

E. T/M/S RETIREMENT

The US Navy currently operates 68 different type/model/series (T/M/S) aircraft.[34] Several initiatives to reduce this number are occurring in naval aviation in order to reduce overall aircraft support costs. For example, a number of aircraft have been selected for retirement, including the single seat F/A-18A and two seat F/A-18B models. Hence, retirement of either the F-5E/F or F/A-18A/B is a benefit to the Navy by supporting its cost savings objectives.

The F-5 Tiger II single seat model E and the two seat model F were built in 1971. The F-5E/F aircraft are modifications of the original F-5 Tiger designed by Northrop in 1954. The F-5E/F aircraft are slated to remain in service for another 12 years until 2015. To date, no replacement aircraft have been identified to replace the F-5s.

The F/A-18A/B Hornet are scheduled for retirement. By 2007, 65 F/A-18A and 5 F/A-18B aircraft will be retired.[35] The first F/A-18A/B models were delivered to the fleet in 1989. Table 4 displays the projected F/A-18A/B aircraft retirement schedule through 2012.

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[34] Optimizing the Size of Naval Aviation's Aircraft Inventory, Naval Air Systems Command, Powerpoint Presenatation April 24,2003.

[35] USNavy Aircraft Inventory Budget Exhibit A-II, Office of the Chief of Naval Aviation, Director Air Warfare (N78), 2003

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
FA-18A	192	140	140	129	127	127	127	114	92	58
FA-18B	33	33	33	28	28	28	28	23	23	23

Table 4. Projected F/A-18 Aircraft Retirement

Hence, the retirement of the F/A-18A/B in 2007 will provide a benefit to the Navy by supporting the Navy's efforts to reduce the number of T/M/S. In fact, retirement of either the F/A-18A/B or the F-5E/F will be provide a benefit to the Navy. Yet, the retirement of the F-5E/F will provide a greater benefit to the Navy than the F/A-18A/B as the Navy will be losing a T/M/S aircraft that is more dissimilar to other aircraft. This is beneficial because of the various support costs associated with the F-5E/F that will go away. The F/A-18A/B's retirement will not have the same beneficial impact on reduction of aircraft support costs as they are still supporting F/A-18C/D and E/F's. In the context of the alternatives analyzed in this CBA, choosing to retire the F-5E/F and replacing it with the F/A-18A/B, therefore, provides a greater benefit to the Navy than choosing to retain the F-5E/F T/M/S. As T/M/S is a qualitative benefit and does not have any measurement indicators, it will not be addressed again until the recommendations section.

F. READINESS

Especially in war time, as recently experienced during the Iraq War, spare parts availability is lower for the F/A-18A/B than the F-5E/F due to prioritization of spare parts going to the F-18C/D's and E/F's.[36] This readiness delta in the context of spare parts availability provides a benefit to the F-5 alternatives for this CBA. Furthermore, with the Navy receiving 32 low-flight-time Swiss F-5E aircraft to replace the current higher-flight-time aircraft, VFC-13 will be in a better readiness position than using the higher-flight-time and higher-cost F/A-18A/B aircraft.[37] As readiness is a qualitative benefit and does not have any measurement indicators, it will not be addressed again until the recommendations section.

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[36] Suggs, William LCDR. VFC-13, Operations Officer. Telephone interview with LCDR Rob DeGuzman. NPS, Monterey, California, November 14, 2003.

[37] Sirak, Michael. Iraq war delays edelivery of Swiss F-5Es to US Navy. Jane's Defence Weekly, April 30, 2003.

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VI. PREDICT IMPACTS QUANTITATIVELY OVER LIFE OF PROJECT

Step 4 of a CBA is to quantify impacts that can be reasonably quantified for each alternative over the life of the project. The Flying Hour Program direct cost categories of Fuel, AVDLRs, Maintenance Consumables, and Contract Maintenance, as well as the Contract Administration Costs (Contract Closeout and Contract Solicitation Costs) and Training costs (F/A-18A/B 4th generation radar capabilities) are measured in dollars and their future impacts will be discussed monetarily in the monetized impacts section. The benefits of safety are not measured in dollars; however, the calculation of safety benefits per year to monetized units will be presented in the monetized impact section as well. The qualitative benefits of training, T/M/S reduction, and readiness do not have any measurement indicators and will not be addressed again until the recommendations section.

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VII. MONETIZED IMPACTS

The fifth step of a CBA is to monetize each of the impacts identified in step 3. [38] The impacts to be monetized include the direct flying hour program costs, contract administration costs, training costs, and safety benefits.

A. FLYING HOUR PROGRAM COSTS

The cost per flight hour is calculated from two types of data collected from a variety of sources. These two categories are informational and budgetary. The Type Commander (CNAR) provides the informational elements such as number of aircraft, utilization and mission requirements. The budgetary elements as grouped by Aviation Fleet Maintenance (OFC-50) have direct impact on determining the cost per flying hour for each type of aircraft. This CBA will focus on the following key budgetary cost elements: Fuel (FF), Maintenance Consumables (FM), Contract Maintenance (FW), Aviation Depot Level Repairables (FA), and Contract Administration Costs. In accordance with OFC-50, Maintenance and Contract costs have been grouped together as one category of direct costs titled Maintenance/Contract (FM/FW) costs. Contract Administration Costs are composed of contract solicitation and contract closeout costs. The annual operational costs for both the F-5E/F and F/A-18A/B are listed in Table 5. These total costs for the F-5E/F and F/A-18A/B programs will be used to calculate a cost per flying hour.

[38] Boardman, Anthony, et al. Cost-Benefit Analysis: *Concepts and Practice*, *Second Edition*. New Jersey: Prentice Hall, 2001.

Category	FY02 Costs
Northrop F-5E/F Tiger II	
AVDLR (FA)	$ 14,573,173
Fuel (FF)	$ 6,982,837
Maintenance/Contracts (FM/FW)	$ 23,802,925
Annual Cost	**$ 45,358,935**
Boeing F/A-18A/B Hornet	
AVDLR (FA)	$ 26,981,714
Fuel (FF)	$ 15,899,947
Maintenance/Contracts (FM/FW)	$ 26,450,009
Annual Cost	**$ 69,331,670**

Table 5. FY02 Annual Operational Costs for F-5E/F & F/A-18A/B

The VAMOSC system provides Operating and Support (O&S) costs for all aspects of Naval Aviation from high-level aggregate reports to detailed reports on individual systems during specific time periods. This program was used to obtain actual annual costs incurred given the number of flight hours by both aircraft types during FY02. A VAMOSC extract of the flying hour programs direct costs (FF, FA, FW/FM) are included in appendix B. For the purpose of this CBA, Navy aircraft, flight hours and costs were used to make comparisons between platforms.

The operational costs of the F-5E/F and F/A-18A/B in this CBA will be compared at the contract's target flight hours since the NAVAIR contract with SSS Inc. is based upon 11,600 flight hours. These flight hour costs are relevant costs and are listed in Table 6.

Category	FY02 Costs
Northrop F-5E/F Tiger II	
AVDLR costs per FH	$ 1,256
Maintenance/Contract Costs per FH	$ 2,052
Fuel Costs per FH	$ 602
Total F-5E/F Cost/FH	**$ 3,910**
Boeing F/A-18A/B Hornet	
AVDLR costs per FH	$ 2,326
Maintenance/Contract Costs per FH	$ 2,280
Fuel Costs per FH	$ 1,371
Total F/A-18AB Cost/FH	**$ 5,977**

Table 6. Comparison of Costs for 11,600 Flight Hours

The three major costs for the F-5E/F and F/A-18A/B models: Fuel, AVDLR, and Maintenance/Contracts were entered into Excel. Each cost was divided by the number of flight hours flown by each type of aircraft to determine a Fuel cost per flight hour, AVDLR Cost per flight hour, and Maintenance/Contract Cost per flight hour.

A similar method of data analysis was conducted with the F/A-18A/B costs. In FY02 the F/A18A/B aircraft 27,294 flight hours. Once each cost per flight hour was determined each was multiplied by 11,600 flight hours in order to compare costs. Figures 1 and 2 display the cost elements as a percentage of the flying hours costs for the F-5E/F and F/A-18A/B. The F-5E aircraft and F/A-18A aircraft fly the majority of the flight hours since the F-5F and F/A-18B are primarily used for training of instructor pilots vice aggressor training.

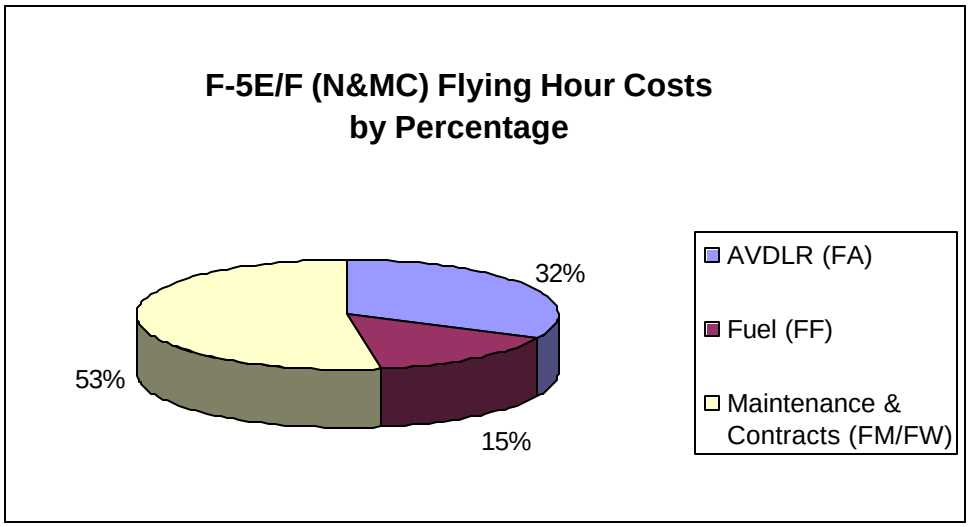

Figure 1. F-5E/F Flying Hour Cost Elements

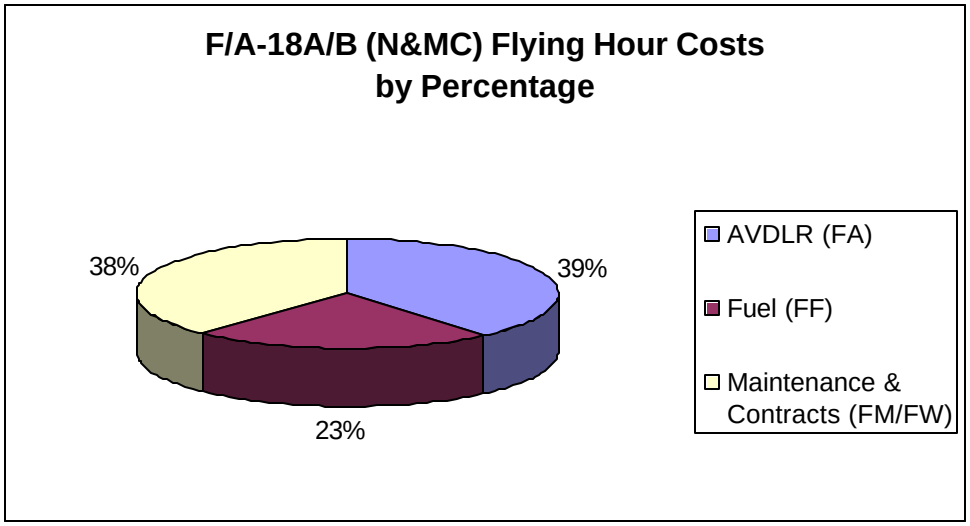

Figure 2. F/A-18A/B Flying Hour Cost Elements

1. Fuel Costs

JP-5 fuel is used by aircraft operating at sea, because it has a higher flashpoint and presents less danger of explosion in a shipboard environment than JP-8. However for aircraft operating from shore facilities JP-8 is used because its chemical composition is almost identical to JP-5 and burns cleaner. Fuel usage for the Department of the Navy is charged at a price established by the Defense Energy Supply Center. The Navy Petroleum Office promulgates the expenditure price for all Navy and Marine Corps activities to report fuel usage each fiscal year. JP-8 jet fuel prices were obtained from the Navy Petroleum Office's Bulk Petroleum Annual Price Lists for FY01-FY04. The actual

costs incurred for fuel by both aircraft types were extracted from the VAMOSC system and divided by the number of flight hours flown to determine a fuel cost per flight hour. Historical data was also used to determine the range of fuel costs for later use in the Crystal Ball simulation. The range for fuel was +/- 22%.

2. Aviation Depot Level Repairables Costs

AVDLR costs were obtained from VAMOSC reports for each type of aircraft. AVDLR costs for the CBA include: AVDLR cost of goods, AVDLR cost recovery, Commercial Aircraft Rework and Commercial Aircraft Engine Rework. These costs were divided by the number of flight hours to estimate an AVDLR cost per flight hour. The range for AVDLR price changes was estimated to by +/- 5%.

3. Maintenance/Contract Costs

Maintenance consumables and contract maintenance costs were also obtained from VAMOSC. In accordance with OFC-50, Maintenance and Contract costs have been grouped together as one category of direct costs titled Maintenance/Contract (FM/FW) costs. Maintenance consumables costs include the costs of the maintenance consumable repair part. Contract maintenance includes contractor logistics support, intermediate level civilian, and contractor support.. The sum of these costs were divided by the number of flight hours flown to estimate the Maintenance/Contract cost per flight hour. The range for Maintenance/Contract costs was estimated to be +/- 7%.

B. CONTRACT ADMINISTRATION COSTS

Having discussed the various issues concerning contract termination, contract claims, and contract closeouts, there are two contract costs directly associated with all three alternatives of the CBA; contract closeout costs and contract solicitation costs. Taking the no cost award option versus the costly termination for convenience alternative involves only contract closeout costs upon the end of performance of the current F-5E/F maintenance contract. Estimated contract closeout costs for the current F-5E/F maintenance contract, based on indirect salary costs, can be up to $1,000[39]. All three alternatives in this CBA involve contract solicitation costs for either the F-5E/F or F/A-18A/B maintenance contract. NAVAIR's indirect salary costs to administer the

[39] Contract Closeout Case Study. MN4371: Principles of Acquisition & Contracting Policy. NPS, Monterey, California, 16 October 2003.

solicitation of either contract will be approximately $500,000.[40] Contract closeout costs and contract solicitation costs are direct costs associated with this CBA, and will occur in 2008 regardless of the alternative selected and are classified irrelevant costs. These costs are not relevant in calculating the cost per flying hour, they will be considered when analyzing all benefits and costs of the three alternatives analyzed in order to provide a complete assessment of benefits and costs.

C. TRAINING COSTS

The 4th generation pulse-doppler radar capabilities of the F/A-18A/B enables the F/A-18A/B to simulate higher threat aircraft, such as the MiG-29, Su-27 and Su-30, for aggressor training purposes. It is this unique training capability of the F/A-18A/B that provides a benefit over the F-5E/F aircraft. The cost to install a 4th generation pulse-doppler radar in the F-5E/F aircraft is $1.5 million per aircraft.[41] As there are currently 23 aircraft in VFC-13, the total installation cost is $34.5 million for the F-5E/F pulse-doppler radar alternative. The $34.5 million installation cost will be an additional cost that must be added to the F-5 total program cost in alternative 3 before computing net present value.

D. SAFETY BENEFITS

The aviation safety data collected from the Naval Safety Center was broken down to severe hazards, where loss of life or serious hazard was likely, and probable and routine hazards, where minor injury was likely and probable. The F-5 has a 7.39% per year and a 22.61% per year less chance of experiencing a severe hazard and routine hazard, respectively, than the F/A-18. Safety benefits for both severe and routine hazards will be monetized 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 (AVDLRs, Maintenance Consumables, and Contract Maintenance). Lost productivity will be prorated using the wage rates for a Navy E-4

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[40] Bolles, Jay. C. NAVAIR PMA225V2. Telephone interview with LT Jesse Porter, NPS, Monterey, California, 27 October 2003.

[41] Suggs, William LCDR. VFC-13, Operations Officer. Telephone interview with LCDR Rob DeGuzman. NPS, Monterey, California, November 14, 2003.

with six years ($36,305/yr)[42] since E-4's perform a majority of the maintenance work where severe and routine hazards usually occur. The average number of lost productivity days for a severe hazard is 14 days and a routine hazard is 1 day. [43] Given a 360-day calendar year, lost productivity for an E-4 with six years is $1,411.86 for a severe hazard and $100.85 for a routine hazard. Applying the F-5 safety benefits of 7.39% and 22.61% per year provides a monetized dollar figure of $104.34 per year for severe hazards and $22.80 per year for routine hazards, providing a total dollar figure of $127.14 per year.

[42]Fiscal year 2003 Military Pay and Allowances. FY2003 Average Annual Salary Charts. December 3, 2003. http://usmilitary.about.com/library/milinfo/pay/blenlistedsalary.htm

[43] Naval Safety Center Hazard Report Data. Updated October 23, 2003. http://www.safetycenter.navy.mil/aviation/aviationdata/hazrepdata.htm

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VIII. DISCOUNTING BENEFITS/COSTS TO OBTAIN PRESENT VALUES

Step 6 of a CBA requires the analyst to discount all benefits and costs to obtain present values of the three alternatives analyzed.[44] In accordance with Office of Budget and Management Circular on Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs (OMB A-94.), a discount rate of 7% will be used to account for the time value of money. Since the OMB A-94 circular states future inflation is highly uncertain and analysts should avoid making assumptions about inflation whenever possible, no provision is made in this study to account for inflation. All computations were completed using Microsoft Office Excel. When calculating NPV, 12 years was analyzed for this CBA (FY2003-2014) due to the remaining projected 12-year service life of the F-5E/F. The safety benefits for operating an F-5E/F in each alternative are displayed in Table 7.

Year	Alternative One	Alternative Two	Alternative Three
2003	$ 127	$ 127	$ 127
2004	$ 127	$ 127	$ 127
2005	$ 127	$ 127	$ 127
2006	$ 127	$ 127	$ 127
2007	$ 127	$ 127	$ 127
2008	$ 127	$ 127	$ 127
2009	$ 127	-	$ 127
2010	$ 127	-	$ 127
2011	$ 127	-	$ 127
2012	$ 127	-	$ 127
2013	$ 127	-	$ 127
2014	$ 127	-	$ 127
CUM. TOTAL	$ 1,526	$ 763	$ 1,526
NPV	$ 1,010	$ 430	$ 1,010

Table 7. Discounted benefit of F-5 radar operation

[44] Boardman, Anthony, et al. Cost-Benefit Analysis: *Concepts and Practice*, *Second Edition*. New Jersey: Prentice Hall, 2001.

The costs associated with each alternative are fuel, AVDLR, contract/maintenance, contract administration and training. Since contract administration costs occur in the last year of a contract, these costs are reflected in 2008. Although pilots welcome the opportunity to train against a higher threat adversary, there is not a clear method to attach a dollar value to the training opportunity. However this CBA does account for the installation cost to provide this training in alternative three.

The costs of continuing to operate the F-5 aircraft to simulate 3rd generation aircraft are displayed in Table 8.

Year	AVDLR	Maint Cons/Contract Costs	Fuel	Contract Closeout & Resolicitation	Training	Yearly Total
2003	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2004	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2005	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2006	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2007	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2008	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ (501,000)	$ -	$ (45,859,935)
2009	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2010	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2011	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2012	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2013	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2014	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
CUM TOTAL	$ (174,878,076)	$ (285,635,100)	$ (83,794,044)	$ (501,000)	$ -	$ (544,808,220)
Net Present Value @ 7% =		**$ (360,605,629)**				

Table 8. NPV Alternative One

The costs associated with alternative two are displayed in Table 9. It reflects the costs that would be incurred by continuing to operate the F-5E/F until 2008 and then converting to the F/A-18A/B aircraft.

Year	AVDLR	Maint Cons/Contract Costs	Fuel	Contract Closeout & Resolicitation	Training	Yearly Total
2003	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2004	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2005	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2006	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2007	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ -	$ -	$ (45,358,935)
2008	$ (26,981,714)	$ (26,450,009)	$ (15,899,947)	$ (501,000)	$ -	$ (69,832,670)
2009	$ (26,981,714)	$ (26,450,009)	$ (15,899,947)	$ -	$ -	$ (69,331,670)
2010	$ (26,981,714)	$ (26,450,009)	$ (15,899,947)	$ -	$ -	$ (69,331,670)
2011	$ (26,981,714)	$ (26,450,009)	$ (15,899,947)	$ -	$ -	$ (69,331,670)
2012	$ (26,981,714)	$ (26,450,009)	$ (15,899,947)	$ -	$ -	$ (69,331,670)
2013	$ (26,981,714)	$ (26,450,009)	$ (15,899,947)	$ -	$ -	$ (69,331,670)
2014	$ (26,981,714)	$ (26,450,009)	$ (15,899,947)	$ -	$ -	$ (69,331,670)
CUM TOTAL	$ (261,737,863)	$ (304,164,688)	$ (146,213,814)	$ (501,000)	$ -	$ (712,617,365)
Net Present Value @ 7% =		**$ (452,720,596)**				

Table 9. NPV Alternative Two

Alternative three involves modification of the existing F-5E/F aircraft by installing a pulse doppler radar system. This one time cost is reflected in the training cost for 2008. The detailed costs for alternative three are listed in Table 10.

Year	AVDLR	Maint Cons/Contract Costs	Fuel	Contract Closeout & Resolicitation	Training	Yearly Total
2003	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	0	$ -	$ (45,358,935)
2004	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	0	$ -	$ (45,358,935)
2005	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	0	$ -	$ (45,358,935)
2006	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	0	$ -	$ (45,358,935)
2007	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	0	$ -	$ (45,358,935)
2008	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	$ (501,000)	$ (34,500,000)	$ (80,359,935)
2009	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	0	$ -	$ (45,358,935)
2010	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	0	$ -	$ (45,358,935)
2011	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	0	$ -	$ (45,358,935)
2012	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	0	$ -	$ (45,358,935)
2013	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	0	$ -	$ (45,358,935)
2014	$ (14,573,173)	$ (23,802,925)	$ (6,982,837)	0	$ -	$ (45,358,935)
CUM TOTAL	$ (174,878,076)	$ (285,635,100)	$ (83,794,044)	$ (501,000)	$ (34,500,000)	$ (579,308,220)
Net Present Value @ 7% =		**$ (383,594,436)**				

Table 10. NPV Alternative Three

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IX. COMPUTE THE NET PRESENT VALUE (NPV) OF EACH ALTERNATIVE

Step 7 of a CBA requires the analyst to compute the NPV of each alternative analyzed.[45] 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 recommendations and conclusions. According to Boardman, if there are multiple mutually exclusive alternatives, pick the one with the highest NPV. A summary of the NPV of each alternative is included in Table 11.

	BENEFITS [PV(B)]	COSTS[PV (C)]	NPV
Alternative one	$ 1,010	$ (360,605,629)	**$ (360,604,619)**
Alternative two	$ 430	$ (452,720,596)	**$ (452,720,166)**
Alternative three	$ 1,010	$ (383,594,436)	**$ (383,593,426)**

Table 11. Summary of NPV for each alternative

[45] Boardman, Anthony, et al. Cost-Benefit Analysis: *Concepts and Practice, Second Edition*. New Jersey: Prentice Hall, 2001.

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X. SENSITIVITY ANALYSIS

Step 8 of a CBA is to perform a sensitivity analysis of the alternatives analyzed. A sensitivity analysis is warranted as there may be considerable uncertainty about both the predicted impacts and the appropriate monetary valuation of each unit of the impact.[46] Crystal Ball is a simulation and modeling software application by Decisioneering Inc. This program was used to create a model of the operational cost of the F-5E/F and F/A-18A/B aircraft. The model was constructed to estimate the effects of changes of four key variables flight hours, fuel cost, AVDLR costs and contract/maintenance costs on the operational costs of the F-5 and F/A-18 aircraft. This section will address the impact of changes in critical elements and their effect on the overall cost of each alternative. Separate simulation runs of 10,000 trials were made for the F-5E/F and F/A-18A/B at 11,600 flight hours.

In order to utilize Crystal Ball for this CBA, a distribution had to be selected for each of the four variables tested. A triangle distribution was used for flight hours because the NAVAIR contract with SSS Inc. established a target number of 11,600 flight hours. In addition, the contract set a minimum number of 1,000 and a maximum of 11,820 flight hours. Since the actual number of flight hours flown in FY02 exceed the maximum number of flight hours in the contract, 14,000 was used in this simulation. Since the probability of the actual costs falling anywhere within the established ranges for Maintenance, AVDLR and Contract Maintenance was equally likely to occur a uniform distribution was used. Table 12 contains the ranges based upon historical data, as explained in the Computing Costs section of this CBA.

Symbol	Cost Elements	Range
FF	Fuel	+/- 22%
FA	AVDLR	+/- 5%
FM/FW	Maintenance/Contracts	+/- 7%

Table 12. Ranges for each Crystal Ball variable

[46] Boardman, Anthony, et al. Cost-Benefit Analysis: *Concepts and Practice, Second Edition*. New Jersey: Prentice Hall, 2001.

The histogram in Figure 3 was produced by Crystal Ball. As a result of the 10,000 trials conducted the cost per flight hour for the F-5E/F was approximately $3,886.33. This cost will be used by Crystal Ball to conduct sensitivity analysis, compare alternatives and make recommendations.

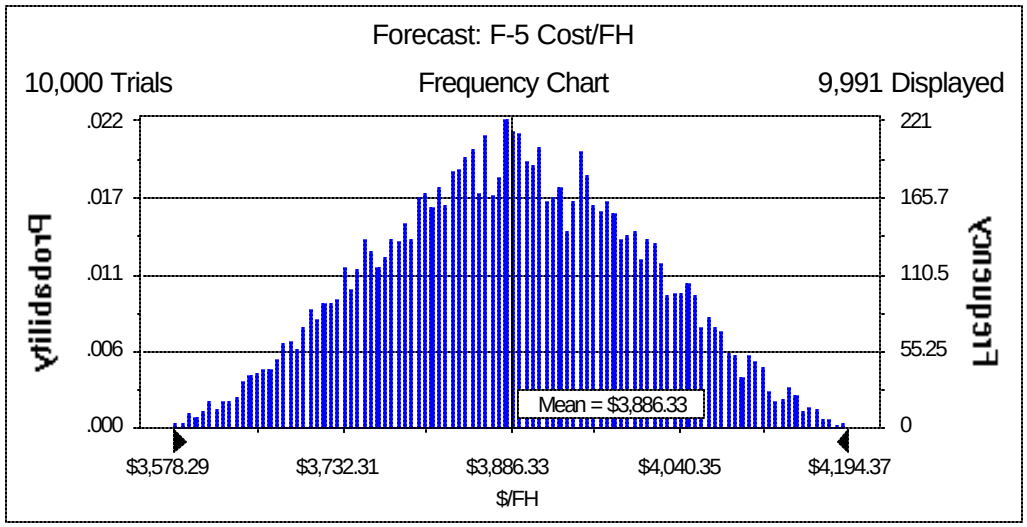

Figure 3. Estimated F-5E/F Cost per Flight Hour

The histogram in Figure 4 was also produced by Crystal Ball. As a result of the 10,000 trials conducted the cost per flight hour for the F/A-18A/B was approximately $5,976.58. This cost will be used by Crystal Ball to conduct sensitivity analysis, compare alternatives and make recommendations.

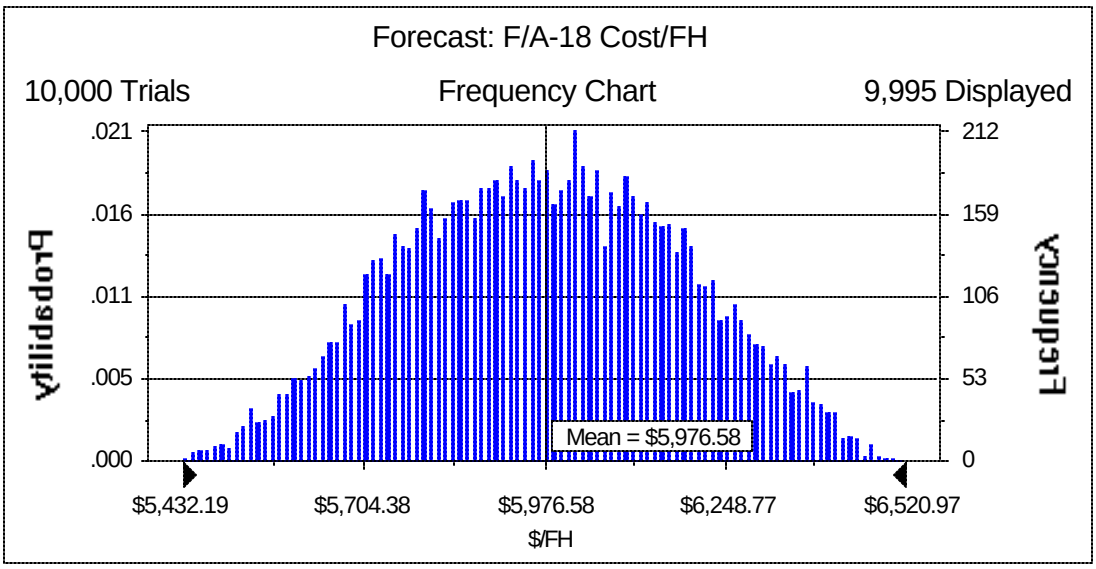

Figure 4. Estimated F/A-18A/B Cost per Flight Hour

The sensitivity analysis was performed using Crystal Ball's Tornado Chart tool. This tool enables the user to analyze the variables used in the model. A tornado chart is used to produce prioritized sensitivity analysis by testing the range of each variable: Fuel Cost, Contract/Maintenance Cost, AVDLR Cost at specified percentiles and calculating the cost per flight hour. A tornado chart measures the effect of each variable on the Cost per flight hour independently while freezing the other variables at the base values to remove their effect on the flight hour cost. It defines an upper and lower limit for each variable. As long as a variable remains within this range the assumptions and the model are valid. This tool replaces the manual method of performing a calculation, recording the results and repeating the process.

Two separate tornado charts were produced by Crystal Ball, one for each type of aircraft. In Figure 5 the most sensitive variable is the F-5 Maintenance Cost per Flight Hour. This cost was estimated by Crystal Ball to be $3,886.33/FH. The centerline of the tornado chart is centered on this value. The tornado chart arranges the variables in a funnel shape. The variable with the largest effect on the cost is contract maintenance and it appears at the top of the chart. The upper limit (upside) and lower limit (downside) of each variable is displayed for each variable. In a worst case the total cost per flight hour could increase by $270.11 to $4,155.37/FH. Conversely the cost per flight hour could decrease by the same amount to $3,615.15/FH. This change in flight hour cost would

increase the annual cost to operate the F-5E/F to $48,202,292 or decrease the cost to $41,935,740.

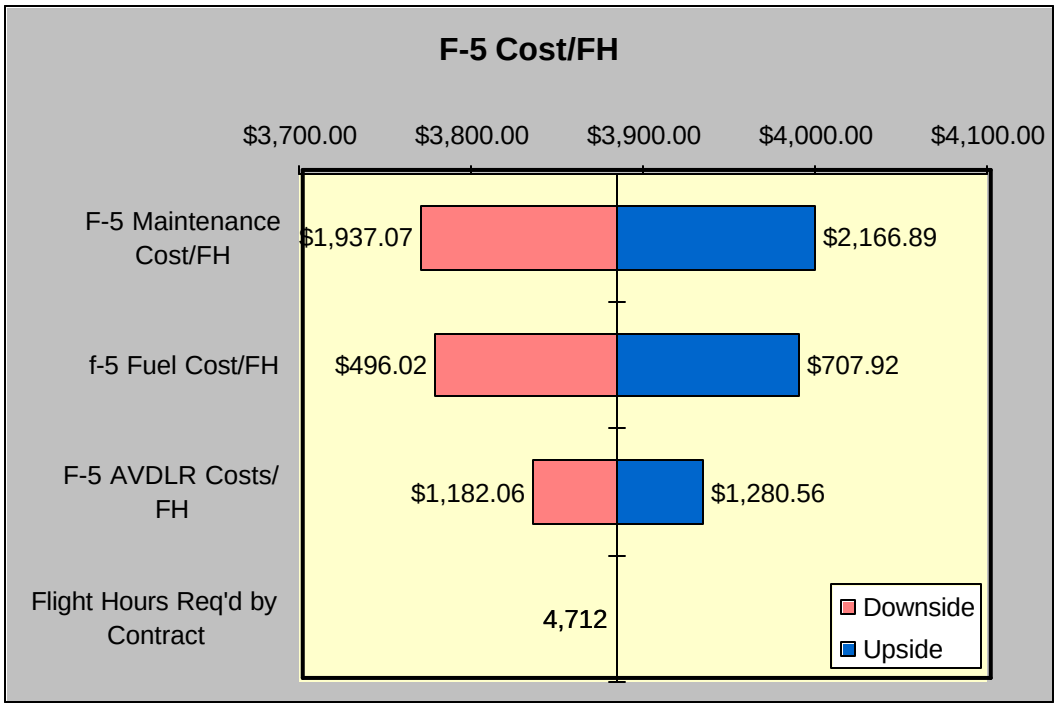

Figure 5. F-5 Tornado Chart

The Tornado chart for the F/A-18 is included in Figure 6. The Crystal Ball model estimated the F/A-18's cost per flight hour at $5,976.58/FH. The most sensitive variable in this model is the F/A-18's Fuel Cost per Flight Hour. The flying hour cost for the F/A-18 could increase by $461.97 to $6,438.84/FH or decrease by the same amount to $5,514.90/FH. This change in flight hour cost would increase the annual cost to operate the F/A-18A/B to $$74,690,530 or decrease the cost to $63,972,810.

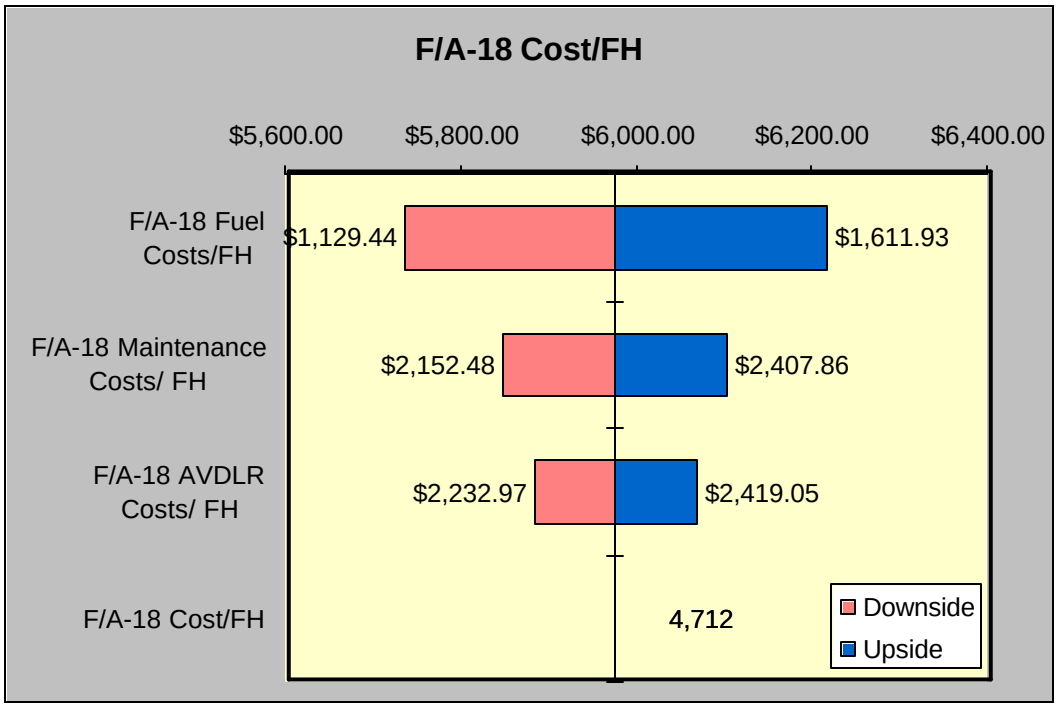

Figure 6. F/A-18 Tornado Chart

As a result of the sensitivity analysis, Table 13 was created to assist in the comparison of effects of the flying hour costs for both aircraft from 2008 to 2014. When a comparison is made between the F/A-18A/B at its best case (lowest) flying hour cost and the F-5E/F at its worst case (highest) flying hour cost, the difference over the life of the program shrinks to $110,393,626. The NPV of this cost is $84,991,886.

Year	F-5E/F Annual Costs	F/A-18A/B Annual Costs
	Worst Case	**Best Case**
2008*	$48,703,292	$64,473,810
2009	$48,202,292	$63,972,810
2010	$48,202,292	$63,972,810
2011	$48,202,292	$63,972,810
2012	$48,202,292	$63,972,810
2013	$48,202,292	$63,972,810
2014	$48,202,292	$63,972,810
Cum. Total	$337,917,044	$448,310,670
NPV @ 7%	**$260,244,326**	**$345,236,211**
Difference	**$84,991,886**	
*Includes 501,000 in Contract Costs in 2008		

Figure 7. Comparison of Costs over life of programs

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XI. CONCLUSIONS & RECOMMENDATIONS

A. CONCLUSIONS

Step 9 of a CBA requires the analyst to make a recommendation based on the NPV and sensitivity analysis. Boardman, recommends that the analyst adopt the project with the largest NPV.[47] This CBA analyzes the NPV of quantifiable impacts of direct flying hour program costs, contract administration costs, and safety benefits. Using Boardman's NPV method, alternative one had a NPV of ($360) million, which was the greatest of the three alternatives analyzed. The NPV of Alternative two was ($453) million while alternative three was ($384) million. There were other qualitative impacts analyzed within the CBA. These qualitative items were training, T/M/S reduction, and readiness. Although alternative one had the highest NPV, factoring in these qualitative benefits could influence the decision maker to choose one of the other more expensive alternatives. For example, given that alternative one is $93 million less than alternative two, the decision maker could be influenced to select alternative two if the qualitative benefits favors this option.

1. Alternative One – Continue the status quo with operation of the F-5 E/F.

Alternative one involves continuing the status quo and operating the F-5E/F to simulate 3rd generation combat aircraft. The Office of the Chief of Naval Aviation, Director Air Warfare (N78) has determined the F-5E/F will remain in service until at least 2014. This alternative had the highest NPV and is the best alternative based upon the quantitative results of this CBA. .

- The F-5E/F possesses the lowest cost per flight hour.

The cost per flight hour for the F-5E/F is $2,067 less than the F/A-18A/B. The cost for the F/A-18A/B to perform the aggressor squadron mission from 2008-2014

[47] Boardman, Anthony, et al. Cost-Benefit Analysis: *Concepts and Practice*, *Second Edition*. New Jersey: Prentice Hall, 2001.

would be $84,991,886 (discounted at 7%.) This figure is calculated by comparing the F/A-18's best case (lowest) operational cost to the F-5's worst case (highest) cost.

- F-5E/F provides 3rd generation adversary training capabilities.

The F-5E/F possesses a 3rd generation pulse radar which allows the aircraft to simulate lower threat aircraft such as the MiG-21, as opposed to higher threat aircraft, such as the MiG-29, Su-27, and Su-30. Although MiG-21's are a lower threat aircraft, there are more MiG 21's in operation worldwide than 4th generation adversaries. There are over 8,000 MiG-21's in existence flown by approximately 40 countries per appendix E.[48] This means that there is a greater chance of encountering a MiG-21 than any other threat aircraft. The F-5E/F therefore performs a beneficial adversary role.

- F-5E/F possesses a readiness benefit due to greater spare parts availability.

As recently experienced during the Iraqi War, spare parts availability is lower for the F/A-18A/B than the F-5E/F. This is due to spare parts priority for the F-18C/D's and E/F's.[49] This readiness delta in the context of spare parts availability provides a benefit to the F-5E/F for this CBA. Furthermore, the Department of the Navy purchased 32 additional F-5E/F aircraft from Switzerland. Each of these aircraft had less than 2000 flight hours as of 2003. Currently, these aircraft are being refurbished by Northrop Grumman and are slated to replace the current F-5's, which have in excess of 6000 flight hours. The deactivated F-5s will be used for spare parts.

- The F-5E/F provides a safety benefit due to its lower aircraft hazard rates.

Aircraft hazard rates can provide a safety benefit. The difference in aircraft hazard rates is a benefit for the aircraft with the lower hazard rate. Which aircraft that possesses the benefit can be determined by comparing the difference in hazard rates between the aircraft. Aviation safety data for both the F-5E/F and F/A-18A/B was retrieved from the Naval Safety Center Aviation Data and Analysis Division. There is a

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[48] Global Aircraft. Accessed December 4, 2003. www.globalaircraft.org.

[49] Suggs, William LCDR. VFC-13, Operations Officer. Telephone interview with LCDR Rob DeGuzman. NPS, Monterey, California, November 14, 2003.

7.39% less chance of a severe hazard and a 22.61% less chance of a routine hazard with the F-5E/F than with the F/A-18A/B.

- Adequate competition exists to compete maintenance contracts.

Adequate competition exists for maintenance of F/A-18A/B aircraft. This fact permits NAVAIR to use fixed price contracts for contractor-supported maintenance.

2. Alternative Two – Replace the F-5E/F with the F/A-18A/B in 2008.

Alternative two involves replacing the F-5E/F with the F/A-18A/B in 2008. This alternative had the worst NPV of the three alternatives analyzed and the highest cost ($452,720,166) over the life of the program. However, this alternative has the most unquantifiable benefits, which could potentially alter a decision maker to choose this alternative if the perceived value of the unquantifiable benefits exceeds the $93 million difference between this alternative and alternative one.

- F/A-18A/B provides true 4th generation adversary training capabilities.

This alternative provides true 4th generation adversary training without the need for modifications. The F/A-18A/B is equipped with a Pulse-Doppler radar system that enables it to simulate high threat aircraft, such as MiG-29, Su-27 and Su-30 aircraft. Fourth generation radar technology provides a significant benefit in Navy pilot adversary training as compared to the F-5E/F. The size, performance and operational envelope of the F/A-18A/B is comparable to and better able to simulate high threat aircraft, than the F-5E/F. The F-5E/F has 3rd generation pulse radar that allows it to simulate low threat aircraft, such as the MiG-21. Although there is a greater chance in encountering a MiG-21, it is in the squadron's best interest to train to the higher threat aircraft. Hence, the F/A-18A/B performs a beneficial adversary role due to its ability to simulate 4th generation adversary aircraft.

- Retiring the F-5E/F contributes to the Navy's T/M/S reduction goal.

Retiring the F-5 contributes to the Chief of Naval Aviation's goal of reducing the number of T/M/S aircraft in the naval inventory. This ultimately reduces overall aircraft

support costs for the active duty inventory and makes funds available for modernization and maintenance upkeep of other naval T/M/S aircraft.

- F/A-18A/B possesses infrastructure cost efficiencies over F-5E/F.

This option takes advantage of the existing maintenance and support infrastructure for the F/A-18A/B aircraft. The F/A-18A/B's retirement will not have the same beneficial impact on reducing aircraft support costs as that of the F-5E/F's retirement because the navy infrastructure is still supporting F/A-18C/D and E/F's.

- Adequate competition exists to compete maintenance contracts.

Adequate competition exists for maintenance of F/A-18A/B aircraft. This fact permits NAVAIR to use fixed price contracts for contractor-supported maintenance.

3. Alternative Three – Install pulse doppler radar capabilities on the existing F-5E/F aircraft by 2008, providing 4th generation aircraft simulation characteristics.

Alternative three has the same benefits as alternative one with the addition of installing 4th generation pulse radar capabilities. Alternative three involves installing Pulse-Doppler radar systems on the existing F-5E/F aircraft. This alternative had the second highest NPV. The cost over the life of the program would be $383,594,436.

- F-5E/F permits 4th generation adversary training capabilities.

Operation of the F-5E/F after pulse-doppler radar modification permits simulation of 4th generation aircraft, enabling the F-5E/F to simulate adversary threat of the MiG-21, MiG-29, Su-27 and Su-30 aircraft.

B. RECOMMENDATIONS

1. Cost – NAVAIR should continue to use the F-5E/F Tiger II aircraft for the VFC-13 adversary-training mission through 2014.

If cost savings is the major focus for the decision maker and T/M/S reduction and 4th generation threat simulation training capabilities are of little value, then the recommended solution is alternative one. Alternative one has the highest NPV of -$360 million for the three alternatives analyzed.

2. Best Value-NAVAIR should assess the 4th generation fighter aircraft benefits of the F/A-18A/B to determine if they exceed the difference in costs between the F-5E/F and F/A-18A/B.

If obtaining the best value is the goal of the decision maker, then the decision maker must decide how much value to place on each of the qualitative benefits and reassess the alternatives analyzed. Given that the cost of alternative one is $93 million less than alternative two, the decision maker could select the more costly alternative if the qualitative benefits exceed $93 million.

C. RECOMMENDATIONS FOR FOLLOW ON STUDY

This study, which analyzes the choice between the F-5E/F and F/A-18A/B to perform the Navy's adversary training mission for VFC-13 in Fallon, NV, has generated a number of related issues that were not addresses in this MBA project. The following issues may serve as possible topics for further study:

- Conduct cost/benefit analysis study of contractor supported maintenance compared to maintenance performed by military personnel.
- Conduct cost/benefit analysis of contractor supported maintenance compared to maintenance performed by Navy reserve personnel.
- Effect of retirement of F/A-18A/B aircraft on the spare parts availability in the supply system.

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APPENDIX A. AGGRESSOR SQUADRON HISTORY TIMELINE

1959	Original F-5 Tiger Designed by Northrop
1968	Dissimilar Air Combat Training (DACT) program established by USN
1969	1st DACT Class Convened (Early TOPGUN)
1970	VF-126 receives 4 A-4's for DACT missions
1971	F-5 Tiger II's Built
1972	TOPGUN becomes full fledge independent program VF-43 "Challengers" Established – Oceana VF-126 "Bandits" Established - Miramar
1975	TOPGUN gets 10 F-5E , 3 F-5F from USAF VA-45 (Cecil Field) provides training for A-7 pilots VA-127(Lemoore) provides training for A-7 pilots
1980	VA-45 relocates to Key West, uses A-4 & T-39D for Adversary training
1981	VF-127 becomes dedicated adversary squadron, obtains 3 F-5E's
1983	F/A-18 A/B's Delivered to the Fleet
1984	VA-45 Blackbirds (Key West) becomes full-fledge Aggressor squadron
1985	VA-45 becomes VF-45 (Feb) VF-43 replaces F-5's w/ Israeli F-21A Kfirs
1987	VF-45 Brings back F-5 VA-127 becomes VFA-127 (Mar) ,relocates to Fallon (Oct) TOPGUN exchanges F-5's for F-16N
1988	VFA-127 obtains 8 F-5E's VF-45 acquires 6 F-16N
1989	VF-43 switches back to F-5's (F-21A returned to Israel)
1993	VF-43 Deactivated (Sept) F/A-18 Reserve Squadron VFC-12 assumes VF-43 Duties VFA-126 Decommissioned
1994	VF-45 retires F-16N due to fatigue VFC-12 transitions to FA-18 Hornet

1995	VF-45 gets 7 F-5E's and 2 F-5F to fill void left by F-16N Due to budget cuts, all F-16N's were deactivated
1996	VF-45 deactivated, F/A-18's moved to VFC-12 (Oceana), F-5's moved to VFC-13 (Fallon), VFC-13 transitions from 12 F/A-18 to 25 F-5's VFA-127 scheduled for deactivation Strike U, TOPGUN, TOPDOME programs consolidated and moved to NAS Fallon
2007	65 F/A-18A, 5 F/A-18B scheduled for retirement
2015	F-5E/F projected retirement

APPENDIX B. VAMOSC EXTRACT OF FLYING HOUR PROGRAM COSTS

F/A – 18A 2000			
	Then Year Dollars	Constant FY02 Dollars	Count
1.2.4.1.1.1 AVDLR Cost of Goods- Navy	46,132,385	48,504,243	
1.2.4.1.1.2 AVDLR Cost of Goods - Marines	32,578,198	34,253,179	
1.2.4.1.2.1 AVDLR Cost Recovery- Navy	5,812,681	6,111,535	
1.2.4.1.2.2 AVDLR Cost Recovery - Marines	4,104,853	4,315,901	
3.1.2 Commercial Aircraft Rework Costs			
3.3.2 Commercial Aircraft Engine Rework Costs			
4.1.2.4.1.1.1 FRS AVDLR Cost of Goods- Navy	2,030,956	2,135,376	
4.1.2.4.1.1.2 FRS AVDLR Cost of Goods - Marines	3,277,100	3,445,589	
4.1.2.4.1.2.1 FRS AVDLR Cost Recovery- Navy	255,900	269,057	
4.1.2.4.1.2.2 FRS AVDLR Cost Recovery - Marines	412,915	434,145	
1.2.5.1 Fuel Costs- Navy	17,338,052	27,758,649	
1.2.5.2 Fuel Costs- Marines	11,888,819	19,034,293	
4.1.2.5.1 FRS Fuel Costs- Navy	491,772	787,339	
4.1.2.5.2 FRS Fuel Costs - Marines	996,908	1,596,074	
2.1.2 Intermediate Civilian Personnel Costs	109,000	118,285	
2.1.3 Intermediate Contractor Personnel Costs	89,000	90,622	
7.1.1 Contractor Logistics Support Costs - Regular - Navy	8,511,519	8,666,652	
7.1.2 Contractor Logistics Support Costs - Regular - Marines			
7.2.1 Contractor Logistics Support Costs - FRS - Navy	83,571	85,094	
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
A1.1.1 Regular Aircraft Number- Navy			98
A1.1.2 Regular Aircraft Number- Marines			77
A1.2.1 FRS Aircraft Number- Navy			3
A1.2.2 FRS Aircraft Number- Marines			5
A2.1.1 Regular Annual Flying Hours- Navy			23,157
A2.1.2 Regular Annual Flying Hours- Marines			19,148
A2.2.1 FRS Annual Flying Hours- Navy			665
A2.2.2 FRS Annual Flying Hours- Marines			1,241
Total Then Year	**$ 134,113,629**		
Total Constant Year		**$ 157,606,033**	
Total Number of Aircraft	**183**		
Total Flying Hours	**44,211**		
Cost Per Aircraft	**732,861**	**861,235**	
Cost Per Flying Hour	**3,033**	**3,564.86**	

F/A – 18A 2001			
	Then Year Dollars	Constant FY02 Dollars	Count
1.2.4.1.1.1 AVDLR Cost of Goods- Navy	42,472,582	43,557,154	
1.2.4.1.1.2 AVDLR Cost of Goods - Marines	30,767,109	31,552,773	
1.2.4.1.2.1 AVDLR Cost Recovery- Navy	9,726,221	9,974,589	
1.2.4.1.2.2 AVDLR Cost Recovery - Marines	7,045,668	7,225,585	
3.1.2 Commercial Aircraft Rework Costs			
3.3.2 Commercial Aircraft Engine Rework Costs			
4.1.2.4.1.1.1 FRS AVDLR Cost of Goods- Navy	1,559,760	1,599,590	
4.1.2.4.1.1.2 FRS AVDLR Cost of Goods - Marines	3,505,055	3,594,560	
4.1.2.4.1.2.1 FRS AVDLR Cost Recovery- Navy	357,185	366,306	
4.1.2.4.1.2.2 FRS AVDLR Cost Recovery - Marines	802,657	823,154	
1.2.5.1 Fuel Costs- Navy	25,337,056	24,942,958	
1.2.5.2 Fuel Costs- Marines	20,909,055	20,583,830	
4.1.2.5.1 FRS Fuel Costs- Navy	911,929	897,745	
4.1.2.5.2 FRS Fuel Costs - Marines	1,601,882	1,576,966	
2.1.2 Intermediate Civilian Personnel Costs	1,284,108	1,340,405	
2.1.3 Intermediate Contractor Personnel Costs	3,677	3,691	
7.1.1 Contractor Logistics Support Costs - Regular - Navy	11,019,022	11,059,944	
7.1.2 Contractor Logistics Support Costs - Regular - Marines	10,391	10,430	
7.2.1 Contractor Logistics Support Costs - FRS - Navy	178,997	179,662	
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
A1.1.1 Regular Aircraft Number- Navy			96
A1.1.2 Regular Aircraft Number- Marines			76
A1.2.1 FRS Aircraft Number- Navy			4
A1.2.2 FRS Aircraft Number- Marines			5
A2.1.1 Regular Annual Flying Hours- Navy			23,783
A2.1.2 Regular Annual Flying Hours- Marines			19,483
A2.2.1 FRS Annual Flying Hours- Navy			869
A2.2.2 FRS Annual Flying Hours- Marines			1,280
Total Then Year	**$ 157,492,354**		
Total Constant Year		**$ 159,289,342**	
Total Number of Aircraft	**181**		
Total Flying Hours	**45,415**		
Cost Per Aircraft	**870,124**	**880,052**	
Cost Per Flying Hour	**3,468**	**3,507.42**	

F/A – 18A 2002			
	Then Year Dollars	Constant FY02 Dollars	Count
1.2.4.1.1.1 AVDLR Cost of Goods- Navy	49,203,263	49,060,986	
1.2.4.1.1.2 AVDLR Cost of Goods - Marines	35,361,622	35,259,370	
1.2.4.1.2.1 AVDLR Cost Recovery- Navy	6,248,815	6,230,746	
1.2.4.1.2.2 AVDLR Cost Recovery - Marines	4,490,926	4,477,940	
3.1.2 Commercial Aircraft Rework Costs			
3.3.2 Commercial Aircraft Engine Rework Costs			
4.1.2.4.1.1.1 FRS AVDLR Cost of Goods- Navy	2,355,028	2,348,218	
4.1.2.4.1.1.2 FRS AVDLR Cost of Goods - Marines	3,255,815	3,246,400	
4.1.2.4.1.2.1 FRS AVDLR Cost Recovery- Navy	299,089	298,224	
4.1.2.4.1.2.2 FRS AVDLR Cost Recovery - Marines	413,488	412,292	
1.2.5.1 Fuel Costs- Navy	27,328,944	27,328,944	
1.2.5.2 Fuel Costs- Marines	20,740,489	20,740,489	
4.1.2.5.1 FRS Fuel Costs- Navy	356,614	356,614	
4.1.2.5.2 FRS Fuel Costs - Marines	1,851,212	1,851,212	
2.1.2 Intermediate Civilian Personnel Costs	1,519,569	1,519,569	
2.1.3 Intermediate Contractor Personnel Costs	173,432	172,586	
7.1.1 Contractor Logistics Support Costs - Regular - Navy	13,466,660	13,400,995	
7.1.2 Contractor Logistics Support Costs - Regular - Marines			
7.2.1 Contractor Logistics Support Costs - FRS - Navy	25,307	25,184	
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
A1.1.1 Regular Aircraft Number- Navy			94
A1.1.2 Regular Aircraft Number- Marines			77
A1.2.1 FRS Aircraft Number- Navy			1
A1.2.2 FRS Aircraft Number- Marines			3
A2.1.1 Regular Annual Flying Hours- Navy			23,709
A2.1.2 Regular Annual Flying Hours- Marines			19,669
A2.2.1 FRS Annual Flying Hours- Navy			272
A2.2.2 FRS Annual Flying Hours- Marines			1,011
Total Then Year	**$167,090,273**		
Total Constant Year		**$ 166,729,769**	
Total Number of Aircraft	**175**		
Total Flying Hours	**44,661**		
Cost Per Aircraft	**954,802**	**952,742**	
Cost Per Flying Hour	**3,741**	**3,733.23**	

F/A – 18B 2000			
	Then Year Dollars	Constant FY02 Dollars	Count
1.2.4.1.1.1 AVDLR Cost of Goods- Navy	1,629,148	1,712,910	
1.2.4.1.1.2 AVDLR Cost of Goods - Marines			
1.2.4.1.2.1 AVDLR Cost Recovery- Navy	205,272	215,826	
1.2.4.1.2.2 AVDLR Cost Recovery - Marines			
3.1.2 Commercial Aircraft Rework Costs			
3.3.2 Commercial Aircraft Engine Rework Costs			
4.1.2.4.1.1.1 FRS AVDLR Cost of Goods- Navy	513,604	522,965	
4.1.2.4.1.1.2 FRS AVDLR Cost of Goods - Marines	1,516,594	1,544,236	
4.1.2.4.1.2.1 FRS AVDLR Cost Recovery- Navy	1,755,240	1,845,484	
4.1.2.4.1.2.2 FRS AVDLR Cost Recovery - Marines	1,271,105	1,336,458	
1.2.5.1 Fuel Costs- Navy	221,161	232,532	
1.2.5.2 Fuel Costs- Marines	160,159	168,393	
4.1.2.5.1 FRS Fuel Costs- Navy	897,183	1,436,412	
4.1.2.5.2 FRS Fuel Costs - Marines			
	660,605	1,057,645	
	489,582	783,833	
2.1.2 Intermediate Civilian Personnel Costs			
2.1.3 Intermediate Contractor Personnel Costs			
7.1.1 Contractor Logistics Support Costs - Regular - Navy	26,000	28,215	
7.1.2 Contractor Logistics Support Costs - Regular - Marines	11,000	11,200	
7.2.1 Contractor Logistics Support Costs - FRS - Navy	1,076,997	1,096,627	
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
7.2.2 Contractor Logistics Support Costs - FRS - Marines	72,072	73,386	
A1.1.1 Regular Aircraft Number- Navy			
A1.1.2 Regular Aircraft Number- Marines			
A1.2.1 FRS Aircraft Number- Navy			9
A1.2.2 FRS Aircraft Number- Marines			
A2.1.1 Regular Annual Flying Hours- Navy			7
A2.1.2 Regular Annual Flying Hours- Marines			4
A2.2.1 FRS Annual Flying Hours- Navy			1,233
A2.2.2 FRS Annual Flying Hours- Marines			
Total Then Year			950
Total Constant Year			629
Total Number of Aircraft	**$ 10,505,722**		
Total Flying Hours		**$ 12,066,122**	
Cost Per Aircraft	**20**		
Cost Per Flying Hour	**2,812**		

F/A – 18B 2001			
	Then Year Dollars	Constant FY02 Dollars	Count
1.2.4.1.1.1 AVDLR Cost of Goods- Navy	1,539,709	1,579,027	
1.2.4.1.1.2 AVDLR Cost of Goods - Marines			
1.2.4.1.2.1 AVDLR Cost Recovery- Navy	352,593	361,597	
1.2.4.1.2.2 AVDLR Cost Recovery - Marines			
3.1.2 Commercial Aircraft Rework Costs			
3.3.2 Commercial Aircraft Engine Rework Costs			
4.1.2.4.1.1.1 FRS AVDLR Cost of Goods- Navy	1,139,245	1,143,476	
4.1.2.4.1.1.2 FRS AVDLR Cost of Goods - Marines	750,203	752,989	
4.1.2.4.1.2.1 FRS AVDLR Cost Recovery- Navy	2,000,144	2,051,220	
4.1.2.4.1.2.2 FRS AVDLR Cost Recovery - Marines	1,335,600	1,369,706	
1.2.5.1 Fuel Costs- Navy	458,033	469,730	
1.2.5.2 Fuel Costs- Marines	305,852	313,662	
4.1.2.5.1 FRS Fuel Costs- Navy	1,105,063	1,087,874	
4.1.2.5.2 FRS Fuel Costs - Marines			
	1,779,057	1,751,385	
	864,797	851,346	
2.1.2 Intermediate Civilian Personnel Costs			
2.1.3 Intermediate Contractor Personnel Costs			
7.1.1 Contractor Logistics Support Costs - Regular - Navy	16,803	17,540	
7.1.2 Contractor Logistics Support Costs - Regular - Marines	562	564	
7.2.1 Contractor Logistics Support Costs - FRS - Navy	1,810,998	1,817,724	
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
7.2.2 Contractor Logistics Support Costs - FRS - Marines	186,003	186,694	
A1.1.1 Regular Aircraft Number- Navy			
A1.1.2 Regular Aircraft Number- Marines			
A1.2.1 FRS Aircraft Number- Navy			9
A1.2.2 FRS Aircraft Number- Marines			
A2.1.1 Regular Annual Flying Hours- Navy			7
A2.1.2 Regular Annual Flying Hours- Marines			4
A2.2.1 FRS Annual Flying Hours- Navy			1,528
A2.2.2 FRS Annual Flying Hours- Marines			
Total Then Year			1,480
Total Constant Year			680
Total Number of Aircraft	**$ 13,644,662**		
Total Flying Hours		**$ 13,754,534**	
Cost Per Aircraft	**20**		
Cost Per Flying Hour	**3,688**		

F/A – 18B 2002			
	Then Year Dollars	Constant FY02 Dollars	Count
1.2.4.1.1.1 AVDLR Cost of Goods- Navy	2,382,836	2,375,946	
1.2.4.1.1.2 AVDLR Cost of Goods - Marines			
1.2.4.1.2.1 AVDLR Cost Recovery- Navy	302,620	301,744	
1.2.4.1.2.2 AVDLR Cost Recovery - Marines			
3.1.2 Commercial Aircraft Rework Costs			
3.3.2 Commercial Aircraft Engine Rework Costs			
4.1.2.4.1.1.1 FRS AVDLR Cost of Goods- Navy	2,116,031	2,105,713	
4.1.2.4.1.1.2 FRS AVDLR Cost of Goods - Marines	1,095,896	1,090,552	
4.1.2.4.1.2.1 FRS AVDLR Cost Recovery- Navy	3,109,426	3,100,435	
4.1.2.4.1.2.2 FRS AVDLR Cost Recovery - Marines	2,555,824	2,548,434	
1.2.5.1 Fuel Costs- Navy	394,897	393,756	
1.2.5.2 Fuel Costs- Marines	324,590	323,651	
4.1.2.5.1 FRS Fuel Costs- Navy	2,163,912	2,163,912	
4.1.2.5.2 FRS Fuel Costs - Marines			
	1,300,205	1,300,205	
	946,206	946,206	
2.1.2 Intermediate Civilian Personnel Costs			
2.1.3 Intermediate Contractor Personnel Costs			
7.1.1 Contractor Logistics Support Costs - Regular - Navy	27,151	27,151	
7.1.2 Contractor Logistics Support Costs - Regular - Marines	22,538	22,428	
7.2.1 Contractor Logistics Support Costs - FRS - Navy	2,552,033	2,539,589	
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
7.2.2 Contractor Logistics Support Costs - FRS - Marines	78,230	77,849	
A1.1.1 Regular Aircraft Number- Navy			
A1.1.2 Regular Aircraft Number- Marines			
A1.2.1 FRS Aircraft Number- Navy			8
A1.2.2 FRS Aircraft Number- Marines			
A2.1.1 Regular Annual Flying Hours- Navy			7
A2.1.2 Regular Annual Flying Hours- Marines			4
A2.2.1 FRS Annual Flying Hours- Navy			1,886
A2.2.2 FRS Annual Flying Hours- Marines			
Total Then Year			1,427
Total Constant Year			854
Total Number of Aircraft	**$ 19,372,395**		
Total Flying Hours		**$ 19,317,571**	
Cost Per Aircraft	**19**		
Cost Per Flying Hour	**4,167**		

F – 5E 2000			
	Then Year Dollars	Constant FY02 Dollars	Count
1.2.4.1.1.1 AVDLR Cost of Goods- Navy			
1.2.4.1.1.2 AVDLR Cost of Goods - Marines			
1.2.4.1.2.1 AVDLR Cost Recovery- Navy			
1.2.4.1.2.2 AVDLR Cost Recovery - Marines			
3.1.2 Commercial Aircraft Rework Costs			
3.3.2 Commercial Aircraft Engine Rework Costs			
1.2.5.1 Fuel Costs- Navy	$ 1,742,314	$ 2,789,488	
1.2.5.2 Fuel Costs- Marines			
2.1.2 Intermediate Civilian Personnel Costs	$ 127,000	$ 137,819	
2.1.3 Intermediate Contractor Personnel Costs	$ 69,000	$ 70,258	
7.1.1 Contractor Logistics Support Costs - Regular - Navy	$ 7,253,964	$ 7,386,177	
7.1.2 Contractor Logistics Support Costs - Regular - Marines			
7.2.1 Contractor Logistics Support Costs - FRS - Navy			
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
A1.1.1 Regular Aircraft Number- Navy			20
A1.1.2 Regular Aircraft Number- Marines			
A2.1.1 Regular Annual Flying Hours- Navy			4,785
A2.1.2 Regular Annual Flying Hours- Marines			
Total Then Year	**$ 9,192,278**		
Total Constant Year		**$ 10,383,742**	
Total Number of Aircraft	**20**		
Total Flying Hours	**4,785**		
Cost Per Aircraft	**459,614**	**519,187**	
Cost Per Flying Hour	**1,921**	**2,170.06**	

F – 5E 2001			
	Then Year Dollars	Constant FY02 Dollars	Count
1.2.4.1.1.1 AVDLR Cost of Goods- Navy			
1.2.4.1.1.2 AVDLR Cost of Goods - Marines			
1.2.4.1.2.1 AVDLR Cost Recovery- Navy			
1.2.4.1.2.2 AVDLR Cost Recovery - Marines			
3.1.2 Commercial Aircraft Rework Costs	$ 10,650,995	$ 10,690,550	
3.3.2 Commercial Aircraft Engine Rework Costs			
1.2.5.1 Fuel Costs- Navy	$ 2,805,448	$ 2,761,811	
1.2.5.2 Fuel Costs- Marines			
2.1.2 Intermediate Civilian Personnel Costs			
2.1.3 Intermediate Contractor Personnel Costs	$ 2,176	$ 2,184	
7.1.1 Contractor Logistics Support Costs - Regular - Navy	$ 9,899,685	$ 9,936,450	
7.1.2 Contractor Logistics Support Costs - Regular - Marines			
7.2.1 Contractor Logistics Support Costs - FRS - Navy			
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
A1.1.1 Regular Aircraft Number- Navy			20
A1.1.2 Regular Aircraft Number- Marines			
A2.1.1 Regular Annual Flying Hours- Navy			4,702
A2.1.2 Regular Annual Flying Hours- Marines			
Total Then Year	**$ 23,358,304**		
Total Constant Year		**$ 23,390,995**	
Total Number of Aircraft	**20**		
Total Flying Hours	**4,702**		
Cost Per Aircraft	**1,167,915**	**1,169,550**	
Cost Per Flying Hour	**4,968**	**4,974.69**	

F – 5E 2002			
	Then Year Dollars	Constant FY02 Dollars	Count
1.2.4.1.1.1 AVDLR Cost of Goods- Navy			
1.2.4.1.1.2 AVDLR Cost of Goods - Marines			
1.2.4.1.2.1 AVDLR Cost Recovery- Navy			
1.2.4.1.2.2 AVDLR Cost Recovery - Marines			
3.1.2 Commercial Aircraft Rework Costs	$ 6,853,966	$ 6,820,545	
3.3.2 Commercial Aircraft Engine Rework Costs	$ 1,453,678	$ 1,446,590	
1.2.5.1 Fuel Costs- Navy	$ 2,828,301	$ 2,828,301	
1.2.5.2 Fuel Costs- Marines			
2.1.2 Intermediate Civilian Personnel Costs			
2.1.3 Intermediate Contractor Personnel Costs			
7.1.1 Contractor Logistics Support Costs - Regular - Navy	$ 10,201,440	$ 10,151,697	
7.1.2 Contractor Logistics Support Costs - Regular - Marines			
7.2.1 Contractor Logistics Support Costs - FRS - Navy			
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
A1.1.1 Regular Aircraft Number- Navy			20
A1.1.2 Regular Aircraft Number- Marines			
A2.1.1 Regular Annual Flying Hours- Navy			4,812
A2.1.2 Regular Annual Flying Hours- Marines			
Total Then Year	**$ 21,337,385**		
Total Constant Year		**$ 21,247,133**	
Total Number of Aircraft	**20**		
Total Flying Hours	**4,812**		
Cost Per Aircraft	**1,066,869**	**1,062,357**	
Cost Per Flying Hour	**4,434**	**4,415.45**	

F – 5F 2000			
	Then Year Dollars	Constant FY02 Dollars	Count
1.2.4.1.1.1 AVDLR Cost of Goods- Navy			
1.2.4.1.1.2 AVDLR Cost of Goods - Marines			
1.2.4.1.2.1 AVDLR Cost Recovery- Navy			
1.2.4.1.2.2 AVDLR Cost Recovery - Marines			
3.1.2 Commercial Aircraft Rework Costs			
3.3.2 Commercial Aircraft Engine Rework Costs			
1.2.5.1 Fuel Costs- Navy	$ 1,742,314	$ 2,789,488	
1.2.5.2 Fuel Costs- Marines	$ 1,438,980	$ 2,303,842	
2.1.2 Intermediate Civilian Personnel Costs	$ 127,000	$ 137,819	
2.1.3 Intermediate Contractor Personnel Costs	$ 69,000	$ 70,258	
7.1.1 Contractor Logistics Support Costs - Regular - Navy	$ 7,253,964	$ 7,386,177	
7.1.2 Contractor Logistics Support Costs - Regular - Marines	$ 4,790,460	$ 4,877,772	
7.2.1 Contractor Logistics Support Costs - FRS - Navy			
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
A1.1.1 Regular Aircraft Number- Navy			20
A1.1.2 Regular Aircraft Number- Marines			11
A2.1.1 Regular Annual Flying Hours- Navy			4,785
A2.1.2 Regular Annual Flying Hours- Marines			3,590
Total Then Year	**$ 15,421,718**		
Total Constant Year		**$ 17,565,356**	
Total Number of Aircraft	**31**		
Total Flying Hours	**8,375**		
Cost Per Aircraft	**497,475**	**566,624**	
Cost Per Flying Hour	**1,841**	**2,097.36**	

F – 5F 2001			
	Then Year Dollars	Constant FY02 Dollars	Count
1.2.4.1.1.1 AVDLR Cost of Goods- Navy			
1.2.4.1.1.2 AVDLR Cost of Goods - Marines			
1.2.4.1.2.1 AVDLR Cost Recovery- Navy			
1.2.4.1.2.2 AVDLR Cost Recovery - Marines			
3.1.2 Commercial Aircraft Rework Costs	$ 10,650,995	$ 10,690,550	
3.3.2 Commercial Aircraft Engine Rework Costs			
1.2.5.1 Fuel Costs- Navy	$ 2,805,448	$ 2,761,811	
1.2.5.2 Fuel Costs- Marines	$ 2,313,631	$ 2,277,644	
2.1.2 Intermediate Civilian Personnel Costs			
2.1.3 Intermediate Contractor Personnel Costs	$ 2,176	$ 2,184	
7.1.1 Contractor Logistics Support Costs - Regular - Navy	$ 9,899,685	$ 9,936,450	
7.1.2 Contractor Logistics Support Costs - Regular - Marines	$ 7,320,545	$ 7,347,732	
7.2.1 Contractor Logistics Support Costs - FRS - Navy			
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
A1.1.1 Regular Aircraft Number- Navy			20
A1.1.2 Regular Aircraft Number- Marines			12
A2.1.1 Regular Annual Flying Hours- Navy			4,702
A2.1.2 Regular Annual Flying Hours- Marines			3,477
Total Then Year	**$ 32,992,480**		
Total Constant Year		**$ 33,016,371**	
Total Number of Aircraft	**32**		
Total Flying Hours	**8,179**		
Cost Per Aircraft	**1,031,015**	**1,031,762**	
Cost Per Flying Hour	**4,034**	**4,036.72**	

F – 5F 2002			
	Then Year Dollars	Constant FY02 Dollars	Count
1.2.4.1.1.1 AVDLR Cost of Goods- Navy			
1.2.4.1.1.2 AVDLR Cost of Goods - Marines			
1.2.4.1.2.1 AVDLR Cost Recovery- Navy			
1.2.4.1.2.2 AVDLR Cost Recovery - Marines			
3.1.2 Commercial Aircraft Rework Costs	$ 6,853,966	$ 6,820,545	
3.3.2 Commercial Aircraft Engine Rework Costs	$ 1,453,678	$ 1,446,590	
1.2.5.1 Fuel Costs- Navy	$ 2,828,301	$ 2,828,301	
1.2.5.2 Fuel Costs- Marines	$ 2,265,908	$ 2,265,908	
2.1.2 Intermediate Civilian Personnel Costs			
2.1.3 Intermediate Contractor Personnel Costs			
7.1.1 Contractor Logistics Support Costs - Regular - Navy	$ 10,201,440	$ 10,151,697	
7.1.2 Contractor Logistics Support Costs - Regular - Marines	$ 6,735,509	$ 6,702,666	
7.2.1 Contractor Logistics Support Costs - FRS - Navy			
7.2.2 Contractor Logistics Support Costs - FRS - Marines			
A1.1.1 Regular Aircraft Number- Navy			20
A1.1.2 Regular Aircraft Number- Marines			12
A2.1.1 Regular Annual Flying Hours- Navy			4,812
A2.1.2 Regular Annual Flying Hours- Marines			3,537
Total Then Year	**$ 30,338,802**		
Total Constant Year		**$ 30,215,707**	
Total Number of Aircraft	**32**		
Total Flying Hours	**8,349**		
Cost Per Aircraft	**948,088**	**944,241**	
Cost Per Flying Hour	**3,634**	**3,619.08**	

APPENDIX C. F-5E/F STATEMENT OF WORK

NAVAL TACTICAL AIR WARFARE (NTAW) AIRCRAFT MAINTENANCE
F-5E/F STATEMENT OF WORK

1.0 BACKGROUND

Program Manager Air 225 (PMA225) is delegated authority from and is ultimately responsible and accountable to the Commander, Naval Air Systems Command (COMNAVAIRSYSCOM). Primary support responsibilities for management of the aviation logistics support program are exercised through the Assistant Commander for Fleet Support and Field Activity Management (AIR-4.0). PMA225 has been tasked by COMNAVAIRSYSCOM to provide contract maintenance, logistics management, and administration in support of this Statement of Work (SOW) which provides the concept, performance specifications, and requirements for that support.

1.1 SCOPE

The services described herein shall be performed in accordance with OPNAVINST 4790.2 series. The Contractor shall provide and maintain organizational (O), intermediate (I), limited DEPOT (D) level aircraft maintenance, management, logistics support services and other services as specified herein for aircraft based at Fighter Composite Reserve Thirteen (VFC-13) Fallon NV, and Marine Fighter Squadron Training (VMFT-401) in Yuma AZ (approximately 32 F-5E, and 4 F-5F).

1.2 SYSTEM DESCRIPTIONS

1.2.1 F-5E/F: *The (E) single-place and (F) two-place are high-performance multi-purpose tactical fighters. Two GE J85-21 gas turbine engines equipped with afterburners power the aircraft.*

1.3 SUPPORT CONCEPT

The most important Contractor performance criteria is to provide safe flyable aircraft to complete the Navy's daily flight schedule (see site specific addenda, attachments 1A and 1B, paragraph 3.4).

The Contractor shall provide O, I, and limited D level aircraft maintenance for Naval Tactical Air Warfare (NTAW) assets. This shall include associated support equipment, power plants, airframes, aviation life support systems, electronic and electrical instruments, armament radar/fire control and flight line services in order to meet the flying programs of each activity and its daily mission requirements as stated in each Site Specific Addendum. Organizational, Intermediate, and limited DEPOT level maintenance is that maintenance which is performed at the site where the aircraft are permanently

assigned or on temporary detachment. The Contractor's management shall be structured to ensure that aircraft are maintained to achieve maximum utilization of all assets.

The Navy places special emphasis on hydraulic contamination, Foreign Object Damage (FOD) prevention, tool control, record keeping, compass calibration, corrosion prevention and treatment, tire and wheel maintenance safety, fuel surveillance, oil analysis, support equipment operator training, nondestructive inspection, plane captain training, survival and egress systems maintenance, and individual qualifications. In performance of the services described herein, the Contractor shall maintain an efficient organization, provide adequate supervisory control, and perform all maintenance and other services as specified for the approximate number of aircraft at the following locations:

SITE	UNIT	T/M/S	QNTY.
NAS Fallon	VFC-13	F-5E/F	23
MCAS Yuma	VMF 401	F-5E/F	13

The Contractor shall be fully responsible for the correction of all damage and/or defects, within the limitation of liability, which are incurred that are directly attributed to the Contractor's performance or actions under this contract.

1.4 GOVERNMENT ROLE

The Government's role includes monitoring Contractor performance; managing the Naval Air Training and Operating Procedures Standardization flight manual; Government Furnished Equipment (GFE), facilities, limited Support Equipment. Access to Support Equipment is provided on a no-cost basis as described in attachments referenced herein. The Government reserves the right to review/verify maintenance actions accomplished by the Contractor, monitor and evaluate maintenance data, review Contractor maintenance reports, conduct unscheduled periodic inspections and audits, and observe cleanliness and general maintenance practices.

The assigned US Navy representatives will have responsibilities for the execution of this SOW as follows:

1.4.1 Program Manager Air

The Program Manager Air (PMA) for the F-5 aircraft is PMA225. The PMA is located at COMNAVAIRSYSCOM Patuxent River MD.

1.4.2 Fleet Support Team

The Fleet Support Team (FST) is the in-service engineering and logistics authority for assigned weapon systems. The FST has responsibility for review and approval of changes to specifications and drawings. The FST members have a direct interface with fleet activities, aircraft controlling custodians and PMA offices on engineering and logistics matters related to their assigned programs. The appropriate FST for each aircraft type/model/series (T/M/S) is assigned by the cognizant NAVAIR PMA.

1.4.3 Assistant Program Manager For Logistics

Assistant Program Manager for Logistics (AMPL) will provide logistics management support for the F-5 platform under this contract.

1.4.4 Maintenance Monitoring Team)

The Maintenance Monitoring Team (MMT) will perform the functions as assigned by the COR. The duties of Navy Quality Assurance (QA) personnel become the responsibility of the Contractor's inspector. MMT verifies that Contractor quality assurance is planned properly and carried out. This surveillance and inspection of the Contractor's performance is described in NTAW Contract Maintenance Monitoring Plan (CMMP).

Government Flight Representative

The Contractor is required to comply with the regulations governing ground operations contained in NAVAIRINST 3710.1 series. In the case of this maintenance contract the Government Flight Representative (GFR) responsibilities will include surveillance of Contractor ground operations involving Government aircraft and other aircraft for which the Government assumes at least some of the risk of loss or damage. Specifically these duties will include reviewing Contractor performance to ensure the Contractor is performing in accordance with OPNAV 4790.2 series, Engine Operation Procedures, and verifying Contractor certifications and training. The GFR shall conduct these reviews at least once a year. The GFR will compile a report and will notify the Contractor in writing when the review is completed. Deficiencies will be cited to the Contractor with a copy to the ACO. The GFR will establish a 30-day suspense for corrective action.

1.5 SUPPORT REQUIREMENTS

A separate Maintenance Department with a dedicated workforce shall be established and maintained for VFC-13, and VMFT-401, individually.

The Contractor shall provide O, selected I and limited D level aircraft maintenance. This maintenance shall include associated support equipment, power plants, airframes, aviation life support systems, electronic and electrical instruments, armament radar/fire control and flight line services in order to meet the flying programs of each activity and its daily mission requirements as stated in each Site Specific Addendum. O, selected I and

limited D level maintenance is that maintenance which is performed at the site where the aircraft are permanently assigned or on temporary detachment.

The Contractor's maintenance program shall comply with all provisions of the Chief of Naval Operations (OPNAV) approved maintenance plans and instructions and applicable maintenance manuals and all requirements specified herein. The Government will issue any waivers or deviations on a case-by-case basis in accordance with this contract. In achieving this requirement, the Contractor shall meet the OPNAV objective of continually improving material readiness and safety with the optimum use of economic resources.

1.6 QUALITY MANAGEMENT

The Contractor shall develop, maintain and implement a quality management plan and Maintenance Monitoring Plan and incorporate an effective systemic improvement process for programs not meeting the specific requirements of OPNAV, NAVAIRSYSCOM, COMNAVAIRPAC, COMNAVAIRLANT, COMNAVAIRESFOR, Air Force Technical Orders, local Wing and Squadron instructions and subsequent changes

2.0 APPLICABLE DOCUMENTS

The applicable documents listed below form a part of the basic SOW and the Specific Site Addenda. The Contractor shall comply with all applicable instructions, directives, regulations and orders. Every instruction/regulation is not specifically recreated or listed herein. The following is a list of basic governing documents upon which local regulations are based:

FEDERAL AND NATIONAL REGULATIONS

See Section I Clauses

DEPARTMENT OF DEFENSE (DOD)

DODINST	
4000.25-1-M (MILSTRIP)	*Military Standard Requisitioning and Issue Procedures*
4145.19-R-1	*Storage and Material Handling*
4160.2M	*Defense Reutilization and Marketing Manual (DRMO)*
4161.2-M Administration	*DOD Manual for the Performance of Contract Property*

OPNAV INSTRUCTIONS

OPNAVINST

3710.7 Series NATOPS General Flight and Operating Instructions
4110.2 Series Navy Hazardous Material Control Program Manual
4790.2 Series NAVAL Aviation Maintenance Program (NAMP)
5090.1 Series Environmental and Natural Resources Program Manual
5100.23 Series Navy Occupational Safety and Health
5442.2 Series Aircraft Inventory Reporting System
5530.14 Series DON Physical Security and Loss Prevention
11103.1 Series Adequacy, Assignment and utilization of Bachelor Quarters

TYPE COMMANDER INSTRUCTIONS AND DIRECTIVES

Furnished at the technical library at each command at NAS Fallon NV, and MCAS Yuma AZ.

JOINT TRAVEL REGULATIONS (JTR), VOL. II

PUB 80-106 DEPT. OF HEALTH EDUCATION AND WELFARE (NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH), Criteria and Recommended Standards for Working in Confined Spaces

Specific applicable instructions and regulations will be provided at each site as required.

3.0 FLIGHT SCHEDULE COMMITMENTS

The Contractor shall perform all maintenance necessary to ensure operational readiness and availability of aircraft necessary to meet the flight schedules. All aircraft assigned/issued by the Contractor shall have enough flight hours available to meet the assigned mission before reaching any scheduled maintenance requirement. All aircraft/issued, by the Contractor, for cross-country flight shall have enough flight hours available to meet the mission requirements as determined by the Government.

It is required that aircraft taxi from the line no later than 5 minutes past their published launch time. If launch window is not met, it will be counted as a maintenance-caused mission abort with the exception of delays caused by factors not under Contractor control (e.g. weather, operations). A projected schedule of planned operations will be provided monthly by the activity, and will project through the upcoming three months to aid in planning. Saturday, Sunday, and holiday work will be necessary to meet squadron requirements. See Site Specific Addenda.

3.1 OPERATIONAL READINESS

The Contractor shall maintain aircraft in a state of operational readiness to meet daily operational mission requirements. It is inherent in meeting mission commitments that operational aircraft are available for flight. If the daily operational mission requirements of 80% are not being completed due to a 10% or greater lack of mission

capable aircraft, the Contractor shall submit a corrective action plan within 3 calendar days to the Contracting Officer's Representative (COR) and the Contracting Officer. Additionally, if the contractor is not meeting the monthly flight hour requirements specified in each site specific addendum, the contractor shall submit a corrective action plan within 3 calendar days after the end of the month to the Contracting Officer. The Contractor shall comply with Commander, Naval Air Reserve Forces, 4th MAW, CVWR-20, and local directives to ensure effective use of all aircraft throughout their predicted service life.

3.2 OPERATIONAL REQUIREMENTS AND SURGE CAPABILITY

The Contractor shall provide capability for surge.
See each Site Specific Addenda.

3.3 REQUIRED AIRCRAFT AVAILABILITY

See Site Specific Addenda.

4.0 ORGANIZATIONAL LEVEL MAINTENANCE

The Contractor shall perform all organizational level (O-level) maintenance in accordance with this SOW and the Site Specific Addenda to include those maintenance functions normally performed by an operating unit on a day-to-day basis in support of its mission and in accordance with OPNAVINST 4790.2 series.

4.1 TRANSIENT SERVICES

The Contractor shall perform transient line functions to include directing, parking, securing, aircraft fire guard, and assistance to flight crew for transient Tactical Air Warfare Program aircraft as directed by the Government. See Site Specific Addenda.

4.2 CORRECTIVE MAINTENANCE

The Contractor shall perform corrective maintenance In Accordance With (IAW) applicable aircraft and component maintenance manuals.

4.3 DETACHMENTS

The aircraft will routinely deploy to other USN/USAF/USMC bases for unit training missions. Deployment bases/stations will provide the normal transient type servicing support (normally fuel and liquid oxygen). The Contractor shall be responsible for on-aircraft servicing and maintenance. See Site Specific Addenda.

4.3.1 Detachment Support

The Contractor shall provide the support described in this contract for detachment support operations outside assigned station boundaries. In the event assigned aircraft are not mission capable at a location other than assigned station, the Contractor shall provide the necessary maintenance support. Travel and per diem shall be approved in advance by the COR.

Detachments and services shall be required in support of a combination of aircraft of various type/model/series. When Contractor personnel performing maintenance remain overnight at locations other than assigned station, per diem shall be paid at a rate not to exceed the rates specified in the Joint Travel Regulations (JTR). Personnel may utilize off base accommodations only when Government quarters are not available. Authorization for use of other than Government quarters must be covered by a certification of non-availability or justification by the COR. Reimbursement will be based upon JTR. Travel claims shall be completed and invoiced to the Government within 5 working days upon completion of travel.

(NOTE: The Contractor shall prepare and submit to the COR for approval "Invitational Orders" for all personnel authorized to perform off-site support. All travel shall be in accordance with the Joint Travel Regulations, Vol. II and OPNAVINST 11103.1.)

The following equivalency schedule shall apply to all personnel:

Site Manager - GS-13
Assistant site manager - GS-12
Leadmen/Senior Technicians - GS-9/GS-11
Mechanics - WG-8

When performing at a detached site, the Contractor shall replace at the detached site, at no cost to the Government, personnel who have voluntarily terminated, who have been terminated by the Contractor, or who have been removed from the detached site due to misconduct.

Travel and per diem costs incurred in the replacement and/or relocation of personnel will not be reimbursed when such replacement and/or relocation is accomplished for the Contractor's or employee's convenience. Paid, itemized receipts shall substantiate invoices. At the Government's discretion, Government-furnished transportation may be provided in lieu of commercial transportation. Anticipate delays in excess of 4 hours 10% of the time when Government transportation is provided.

4.4 FUNCTIONAL CHECK FLIGHTS

The Contractor shall support all Functional Check Flights (FCF), in accordance with OPNAVINST 4790.2 series and NAVAIRINST 3710.1 with the exception of in flight operations. In order for an aircraft to be in an FCF status all required work on the aircraft shall be completed. Aircraft shall be preflighted, fueled appropriately for its

designated mission, systems serviced, located on the required launch spot and ready for FCF crew preflight.

5.0 INTERMEDIATE MAINTENANCE

The Contractor shall provide Intermediate ("I") Level Maintenance and manage Production Control and Maintenance Control functions separately. Intermediate level maintenance encompasses; radar repair, Nondestructive Inspection (NDI)/X-ray, and welding; and engine repair. I level repair capabilities shall be shared between sites (see site specific addenda, attachments 1A and 1B).

6.0 LIMITED DEPOT LEVEL MAINTENANCE

The Contractor shall provide limited D level maintenance support for the Naval Tactical Air Warfare Program. All limited D level maintenance shall be provided as an Over and Above action on a case by case basis. Examples of limited D level maintenance support for the F-5E/F aircraft include modification, component repair, aircraft paint (other than corrosion control), repair and/or replacement of airframe structural components/aircraft strain gauges, and integration/installation of various avionics modifications. The Contractor may seek engineering support from non-Government sources with Government/TYCOM approval. Non-Government engineering work must be approved by the FST.

9.0 GOVERNMENT-FURNISHED MATERIAL, EQUIPMENT, AND PROPERTY

The Contractor shall manage Government Furnished Property in accordance with the Government Furnished Property Clauses contained in Section I of this contract, Federal Acquisition Regulations, Subpart 45, and other program requirements. These shall include but are not limited to, the IMRL Program, Tool Control Program, D Level Repairable Material Program, Plant and Minor Property requirements, and Navy Supply System regulations, instructions and directives.

The Contractor shall maintain site specific records of all Government Furnished Property per the requirements of FAR Subpart 45. The Contractor shall use and maintain an automated accounting system for accountability, tracking and inventory of all Government Furnished Property regardless of cost. This system shall be used for all Government Property except IMRL, which shall be tracked and accounted for using the Government Furnished IMRL Program. Contractor records are the official Government records in accordance with Federal Acquisition Regulations, Subpart 45. All Property CDRLs, including contract Phase out turn over records, shall be submitted in EXCEL format.

a. The Contractor shall develop and submit, for Contracting Officer Approval, a Property Control Plan/System in accordance with FAR Subpart 45 and the property

clauses identified in Section I of this contract. This Property Control plan shall incorporate the provisions and requirements of identified property instructions and directives for the accountability, control, use, protection, preservation, inventory, movement, disposition, and maintenance of Government Furnished Property. This Property Control Plan is required thirty days after contract award. Proposed changes to the plan must be submitted to the PCO for approval prior to implementation.

b. The Contractor shall be liable for loss or damage to Government furnished property in accordance with the Government Property Clauses contained in Section I of this Contract. In the case of loss or damage, the Contracting Officer shall determine the amount of the Contractor's liability. The Contractor shall verbally notify the COR within 24 hours of discovery of lost, damaged or destroyed Government Property and provide written notification within (5) workdays after verbal notification. The written report shall be in accordance with FAR 45 requirements for Lost, Damage or Destroyed (LD&D) Government Property. The Contractor shall also prepare and submit a Missing, Lost, Stolen and recovered (MLSR) Report per SECNAVINST 5500.4. The official property records shall be adjusted with an approved DD Form 200, Survey document for all loss or destroyed Government Furnished Property.

c. The Contractor shall dispose of Government Property per direction of the CORs and the Property Administrator. Government Property turned into Defense Reutilization and Marketing Office (DRMO) shall be documented and processed per DODINST 4160.2M and local Installation instructions.

9.1 USE OF THE FEDERAL SUPPLY SYSTEM

The Contractor shall use the Federal Supply System for the requisition of all materials. The Contractor shall perform this function using the standard DD-1348 MILSTRIP/MILSTRAP ordering procedures. When approved by the APML, the Contractor shall be authorized to commercially procure, refurbish, and/or manufacture the material when such material is not available in the Federal Supply System or can be procured commercially at a significant cost saving to the Government.

9.2 PHYSICAL INVENTORY

The Contractor shall, as a minimum, annually or as directed by the COR, conduct a wall to wall physical inventory of Government-furnished material/equipment/property in Contractor custody in accordance with FAR, Subpart 45 and other program directives. Physical inventories shall be conducted annually within 30 days of award and 30 days after exercise of each subsequent contract option year. Physical inventories shall be in accordance with directives and instructions for type of Government Property inventoried. Aviation DEPOT Level Repairable material shall be inventoried Quarterly per NAVSUPINST 4440.115 series. IMRL shall be inventoried per NAVAIR, OPNAV and Type Commander Instructions. Tools and Support Equipment shall be inventoried per NAVAIR, OPNAV and Type Commander Instructions. Plant and Minor Property and

consumable material shall be inventoried per NAVSUPINST and local instructions. The Contractor shall develop and submit an annual inventory schedule for all Government Furnished Property. Inventory results shall be submitted in accordance with direction provided for CDRL submission (see site specific addenda, attachments 1A and 1B).

9.3 INVENTORY ADDITIONS AND DELETIONS

The Government may establish new inventory items not previously listed on the Government-furnished material (GFM) list and/or elect to change (at the Government's option) the quantity of items on the GFM list. The Contractor shall requisition or purchase additional items when approved by the cognizant APML/TYCOM. The Contractor shall initiate and sustain timely repair/replenishment of the GFM to meet contractual requirements.

Contractor justification and recommendations for additions to the GFM shall be forwarded via the TYCOM to the cognizant APML when the Contractor observes usage/failure trends warranting additional spares inventory. All Contractor requests for additions to the GFM shall be negotiated on a case-by-case basis. Deletions to the GFM list shall be approved by the APML and transferred or redistributed in accordance with instructions to be provided by the TYCOM. The Contractor shall maintain the supply of Government-furnished consumable material.

17 REPORTING

The Contractor shall initiate and maintain a standard format of reports. These reports shall be submitted to the Government, as stated in Exhibit A of the contract.

e. Aircraft Status Report – The Contractor shall provide an Aircraft Status Report IAW CDRL, DD Form 1423, Item A005.

i. Daily Aircraft Readiness Status Report – The Contractor shall provide a Daily Aircraft Readiness Status Report IAW CDRL, DD Form 1423, Item A009.

t. F-5E/F Special Interest Items (Top 20 Problem Items) - The Contractor shall provide an F-5E/F Special Interest Items (Top 20 Problems Items) reports IAW CDRL, DD Form 1423, Item A00L.

APPENDIX D. F/A-18A/B STATEMENT OF WORK

NAVAL TACTICAL AIR WARFARE (NTAW) AIRCRAFT MAINTENANCE NSAWC STATEMENT OF WORK

1.0 BACKGROUND

Program Manager Air 225 (PMA-225) is delegated authority from and is ultimately responsible and accountable to the Commander, Naval Air Systems Command (COMNAVAIRSYSCOM). Primary support responsibilities for management of the aviation logistics support program are exercised through the Assistant Commander for Fleet Support and Field Activity Management (AIR-4.0). PMA-225 has been tasked by COMNAVAIRSYSCOM to provide contract maintenance, logistics management, and administration in support of this Statement of Work (SOW) which provides the concept, performance specifications, and requirements for that support.

1.1 SCOPE

The services described herein shall be performed in accordance with OPNAVINST 4790.2 series. The Contractor shall provide and maintain organizational, intermediate, and limited DEPOT level aircraft maintenance, management, logistics support services and other services as specified herein for aircraft based at Naval Strike and Air Warfare Center (NSAWC), Fallon NV (Approximately 26 F/A-18A/B, 7 F-14A, and 2 SH-6 and 2 HH-60 helicopters). Aircraft to be included at a later date upon exercise of contract option include the F-16A/B. Additionally, the Contractor shall provide transient services for F-14B/D, F/A-18C/D, and E-2C aircraft at NAS Fallon.

The Naval Strike and Air Warfare Center (NSAWC) combines the functions of the Naval Strike Warfare Center (NSWC), Navy Fighter Weapons School (NFWS), and the Carrier Airborne Early Warning Weapons School (CAEWWS), into a single command structure to enhance aviation training effectiveness. It focuses on tactics development, assessment, graduate level training, Fallon Range Complex management, joint interoperability, and standardization of training within the aviation communities. Additionally, NSAWC will emphasize cross-community dialogue on an integrated tactical employment of naval assets, and have a role in the requirement process for aviation.

NSAWC will also act to improve and maintain at a high level, naval force overland strike and war-at-sea capabilities and provide the basis for training to include all warfare areas currently required, or foreseen as required. This command melds aviation requirement recommendations and priorities for Research and Development (R&D), procurement and training in support of integrated Strike Warfare and associated strike planning support systems to the type commands. NSAWC provides direct intelligence and tactical doctrine support to deploying/deployed naval forces conducting contingency

planning/operations as directed by national tasking. Upon mobilization, NSAWC will fulfill operational and intelligence requirements in support of wartime tasking and perform such other functions or tasks as may be directed by higher authority.

1.2 SYSTEM DESCRIPTIONS

1.2.2 F/A-18A/B/C/D: The McDonnell Douglas F-/A-18 is an all-weather fighter and attack aircraft. In its fighter mode, the F/A-18 is used primarily as a fighter escort and for fleet air defense. In its attack mode it is used for force projection, interdiction and close and deep air support. Single-place (A) and two-place (B) are fighter/attack aircraft powered by two General Electric F404-GE-400 turbofan engines with afterburner. The F/A-18C/D is powered by two F404-GE-402 enhanced performance turbofan engines.

1.3 SUPPORT CONCEPT

The most important Contractor performance criterion is to provide safe flyable aircraft to complete the Navy's daily flight schedule.

The Contractor shall provide organizational (O), intermediate (I), and limited Depot (D) level aircraft maintenance for Naval Tactical Air Warfare (NTAW) assets. This shall include associated support equipment, power plants, airframes, aviation life support systems, electronic and electrical instruments, armament radar/fire control and flight line services in order to meet the flying programs of each activity and its daily mission requirements. O, I, and limited D level maintenance is that maintenance which is performed at the site where the aircraft are permanently assigned or on temporary detachment. The Contractor's management shall be structured to ensure that aircraft are maintained to achieve maximum utilization of all assets.

The Navy places special emphasis on hydraulic contamination, Foreign Object Damage (FOD) prevention, tool control, record keeping, compass calibration, corrosion prevention and treatment, tire and wheel maintenance safety, fuel surveillance, oil analysis, support equipment operator training, nondestructive inspection, plane captain training, survival and egress systems maintenance, and individual qualifications. In performance of the services described herein, the Contractor shall maintain an efficient organization, provide adequate supervisory control, and perform all maintenance and other services as specified for the approximate number of aircraft at the following locations:

SITE	UNIT	T/M/S	QNTY.
NAS Fallon	NSAWC	F-14A	7
NAS Fallon	NSAWC	F/A-18A	22
NAS Fallon	NSAWC	F/A-18B	4
NAS Fallon	NSAWC	SH-60/HH-60	4

The Contractor shall be fully responsible for the correction of all damage and/or defects, within the limitation of liability, which are incurred that are directly attributed to the Contractor's performance or actions under this contract.

1.4 GOVERNMENT ROLE

The Government's role includes monitoring Contractor performance; managing the Naval Air Training and Operating Procedures Standardization flight manual; Government Furnished Equipment (GFE), facilities, limited Support Equipment. Access to Support Equipment is provided on a no-cost basis as described in attachments referenced herein. The Government reserves the right to review/verify maintenance actions accomplished by the Contractor, monitor and evaluate maintenance data, review Contractor maintenance reports, conduct unscheduled periodic inspections and audits, and observe cleanliness and general maintenance practices.

The assigned US Navy representatives will have responsibilities for the execution of this SOW as follows:

1.4.1 Program Manager Air

The Program Manager Air (PMA) for the F-14A aircraft is PMA 241, F/A-18A/B is PMA 265, SH-60/HH-60 is PMA 299, and the E-2C is PMA 231. All PMAs are located at COMNAVAIRSYSCOM Patuxent River MD.

1.4.2 Fleet Support Team

The Fleet Support Team (FST) is the in-service engineering and logistics authority for assigned weapon systems. The FST has responsibility for review and approval of changes to specifications and drawings. The FST members have a direct interface with fleet activities, aircraft controlling custodians and PMA offices on engineering and logistics matters related to their assigned programs. The appropriate FST for each aircraft type/model/series (T/M/S) is assigned by the cognizant NAVAIR PMA.

1.4.3 Assistant Program Manager For Logistics

Each aircraft (T/M/S) Assistant Program Manager for Logistics (AMPL) will provide logistics management support for its platform under this contract.

1.4.4 Maintenance Monitoring Team

The Maintenance Monitoring Team (MMT) will perform the functions as assigned by the COR. The duties of Navy Quality Assurance (QA) personnel become the responsibility of the Contractor's inspector. MMT verifies that Contractor quality assurance is planned properly and carried out. This surveillance and inspection of the Contractor's performance is described in NTAW Contract Maintenance Monitoring Plan (CMMP).

Government Flight Representative

The Contractor is required to comply with the regulations governing ground operations contained in NAVAIRINST 3710.1 series. In the case of this maintenance contract the Government Flight Representative (GFR) responsibilities will include surveillance of Contractor ground operations involving Government aircraft and other aircraft for which the Government assumes at least some of the risk of loss or damage. Specifically these duties will include reviewing Contractor performance to ensure the Contractor is performing in accordance with OPNAV 4790.2, Engine Operation Procedures, and verifying Contractor certifications and training. The GFR shall conduct these reviews at least once a year. The GFR will compile a report and will notify the Contractor in writing when the review is completed. Deficiencies will be cited to the Contractor with a copy to the ACO. The GFR will establish a 30-day suspense for corrective action.

1.4.6 Procurement Contracting Officer (PCO)

The Government Procurement Contracting Officer directs and administers the acquisition through the award of the contract. After award, the PCO will designate, in writing, the Administrative Contracting Officer (ACO) for the administration of the terms and provisions of this SOW as stipulated in the contract.

1.4.7 Administrative Contracting Officer (ACO)

The ACO performs functions assigned by PCO related to the administration of the contract. See FAR Parts 42 and 46.

1.4.8 Contracting Officer's Representative (COR)

The COR is a representative appointed by the PCO to serve as technical liaison between Government and Contractor for a specific contract. The COR performs primarily technical and oversight functions in accordance with FAR Part 46. The PCO can designate Government personnel to act as authorized representatives. To include such functions as providing to Contractors technical direction, inspection, approval of shop drawings, testing, approval of samples, and other functions of a technical or administrative nature not involving a change in the scope, price, terms or conditions of the contract or order. The COR monitors the Contractor's performance and provides technical advice to the PCO and Contractor within the scope of the SOW.

The COR and Alternate COR (ACOR) shall be nominated by the Commanding Officer of each activity and appointed in writing by the PCO as the contract representative for all matters concerning the Contractor's services received by the activities.

1.5 SUPPORT REQUIREMENTS

The Contractor shall provide O, I and limited D level aircraft maintenance. This maintenance shall include associated support equipment, power plants, airframes, aviation life support systems, electronic and electrical instruments, armament radar/fire control and flight line services in order to meet the flying programs of each activity and its daily mission requirements. O, I, and limited D level maintenance is that maintenance which is performed at the site where the aircraft are permanently assigned or on temporary detachment.

The Contractor's maintenance program shall comply with all provisions of the Chief of Naval Operations (OPNAV) approved maintenance plans and instructions and applicable maintenance manuals and all requirements specified herein. The Government will issue any waivers or deviations on a case-by-case basis in accordance with this contract. In achieving this requirement, the Contractor shall meet the OPNAV objective of continually improving material readiness and safety with the optimum use of economic resources.

1.6 QUALITY MANAGEMENT

The Contractor shall develop, maintain and implement a quality management plan and Maintenance Monitoring Plan and incorporate an effective systemic improvement process for programs not meeting the specific requirements of OPNAV, NAVAIRSYSCOM, COMNAVAIRPAC, COMNAVAIRLANT, COMNAVAIRESFOR, Air Force Technical Orders, local Wing and Squadron instructions and subsequent changes.

1.7 TERMS, DEFINITIONS, AND ABBREVIATIONS (NSAWC ONLY)

All terms/definitions are in accordance with OPNAVINST 3710.7 and 4790.2 series.

1.7.1 Contractor Sortie (KRSC) — Aircraft is physically airborne, lands, and completed its mission

1.7.2 Contractor Mission Complete (KRMCP) — Aircraft performs all requirements as set forth in the flight schedule without abort for maintenance failure and training is accomplished = number of KRSC minus maintenance aborts.

1.7.3 Contractor Mission (KRMS) — Number of flights scheduled minus OA and minus WA Scheduled

1.7.4 Contractor Mission Completion Rate (KRMCR) — Mission Completed = KRMCP divided by KRMS

1.7.5 Contractor Mission Capable (KRMC)	Mission Capable (MC) minus NMCS and minus Planning &Estimating (P&E)

2.0 APPLICABLE DOCUMENTS

The applicable documents listed below form a part of the basic SOW and the Specific Site Addenda. The Contractor shall comply with all applicable instructions, directives, regulations and orders. The following is a list of basic governing documents upon which local regulations are based:

FEDERAL AND NATIONAL REGULATIONS

See Section I Clauses

DEPARTMENT OF DEFENSE (DOD)

DODINST	
4000.25-1-M (MILSTRIP)	Military Standard Requisitioning and Issue Procedures
4145.19-R-1	Storage and Material Handling
4160.2M	Defense Reutilization and Marketing Manual (DRMO)
4161.2-M Administration	DOD Manual for the Performance of Contract Property

OPNAV INSTRUCTIONS

OPNAVINST	
3710.7 Series	NATOPS General Flight and Operating Instructions
4110.2 Series	Navy Hazardous Material Control Program Manual
4790.2 Series	NAVAL Aviation Maintenance Program (NAMP)
5090.1 Series	Environmental and Natural Resources Program Manual
5100.23 Series	Navy Occupational Safety and Health
5442.2 Series	Aircraft Inventory Reporting System
5530.14 Series	DON Physical Security and Loss Prevention
11103.1 Series	Adequacy, Assignment and utilization of Bachelor Quarters

TYPE COMMANDER INSTRUCTIONS AND DIRECTIVES

Furnished at the technical library at each command.

JOINT TRAVEL REGULATIONS (JTR), VOL. II

PUB 80-106	DEPT. OF HEALTH EDUCATION AND WELFARE (NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH),

Specific applicable instructions and regulations will be provided at each site as required.

3.0 FLIGHT SCHEDULE COMMITMENTS

The Contractor shall perform all maintenance necessary to ensure operational readiness and availability of aircraft necessary to meet the flight schedules. The Contractor shall provide safe, flyable aircraft configured to accomplish the mission identified in the daily flight schedule. All aircraft assigned/issued by the Contractor shall have enough flight hours available to meet the assigned mission before reaching any scheduled maintenance requirement. All aircraft issued, by the Contractor, for cross-country flights shall have enough flight hours available to meet the mission requirements as determined by the Government.

It is required that aircraft taxi from the line no later than 5 minutes past their published launch time. If launch window is not met, it will be counted as a maintenance-caused mission abort with the exception of delays caused by factors not under Contractor control (e.g. weather, operations). A projected schedule of planned operations will be provided monthly by the activity, and will project through the upcoming three months to aid in planning. Saturday, Sunday, and holiday work will be necessary to meet squadron requirements.

Approximately 34% of the total flight operations are routinely scheduled for six (6) days per week. Normal workday operations required that aircraft supporting these operations launch as early as 0600 and as late as 2200.

The remaining flight operations (approximately 66%) are routinely scheduled to encompass a 12-hour flying day, 5 days per week. The normal flight schedule for aircraft supporting these operations will be between 0700 and 1900; and weekend flying is ESTIMATED to occur twice per month Saturday and Sunday.

However, in both cases, aircraft may be required to launch earlier or recover later to accommodate operational requirements and may include up to 5 legal holidays. Extended training flights will typically launch on Friday afternoon or evening. There are approximately 6 extended training flights per week.

3.1 OPERATIONAL READINESS

The Contractor shall maintain aircraft in a state of operational readiness to meet daily operational mission requirements. It is imperative for meeting mission commitments that operational aircraft are available for flight. If the daily operational mission requirements are not being completed due to a 10% or greater lack of mission capable aircraft, the Contractor shall submit a corrective action plan within 3 calendar days to the COR. The Contractor shall comply with Commander Naval Air Pacific, Commander Naval Air

Atlantic, and local directives to ensure effective use of all aircraft throughout their predicted service life.

OPERATIONAL REQUIREMENTS AND SURGE CAPABILITY

Aircraft assigned NSAWC missions consist of fixed wing and rotary wing aircraft. The aircraft will be configured with Tactical Air Combat Training System (TACTS) pods, external Electronic Countermeasures (ECM) pods, Forward-Looking Infrared (FLIR), LDT, Air Intercept Missile (AIM-9) captive missiles, Air Launch Expendable (ALE-39) chaff, decoy flares and external fuel tanks. Various air-to-ground weapons will be employed during advanced phases of Strike Fighter Tactics Instructor classes and during staff training outside of classes. All configurations are dictated via the daily flight schedule.

The F-14A is scheduled to fly 20 hours per aircraft per month. Surge capability support can be increased to 30 hours per aircraft per month. Quarterly flight hour totals will not normally exceed the projected 20 hours per aircraft per month rate (7 aircraft x 20 hours per aircraft X 3 months equals 420 hours quarterly subsequent to invoked base loading options).

The F/A-18A/B is scheduled to fly an estimated 25 hours per aircraft per month. Surge capability support can be increased to 35 hours per aircraft per month. Quarterly flight hour totals will not normally exceed the projected 25 hours per aircraft per month. (26 aircraft x 25 hours per month X 3 months equals 1950 flight hours quarterly subsequent to base loading options).

The SH-60/HH-60 is scheduled to fly an estimated 25 hours per aircraft per month. Surge capability support can be increased to 30 hours per aircraft per month. Quarterly flight hour totals will not normally exceed the projected 25 hours per aircraft per month. (4 aircraft X 25 hours per month X 3 months equals 300 flight hours quarterly subsequent to invoked base loading options).

3.3 REQUIRED AIRCRAFT AVAILABILITY

T/M/S	RRS	Minimum Daily **ACFT requirement**	FMC **RATE**	MAX NMCM
F/A-18A	**(22)**	**15**	**70%**	**10%**
F/A-18B	**(4)**	**2**	**50%**	**10%**

Available aircraft will be computed by the following formula:

RSS-NMCS-P&E/ISR-Navy Directed-NMCM=AVAILABLE AIRCRAFT

The sortie completion rate for all T/M/S aircraft is 95%. A complete sortie is when an aircraft completes its mission per the flight schedule. Sorties scheduled will be based upon an average of three sorties per available aircraft per day. Deviations will be coordinated between the Site Manager and COR/MO.

Should any sortie completion rate for any T/M/S fall below the required 95% for any given month, in the respective fiscal year, a reduction in payment will be made in accordance with special contract requirements entitled "Billing Commencement of Services".

Sortie Completion rate of 95% is required: The sortie completion rate (SCR) is intended to identify the percent of total sorties scheduled (minus sorties canceled for weather or other non Contractor related clauses) that are successfully launched and completed. In essence, it is a performance measure of meeting the daily flight schedules and accomplishing the intended missions. The formula for SCR is:

$$SCR\% = \frac{(SCO+SCR+SCA)}{((SS+SR)-(SW+SO))} \times 100\%$$

Where:
SCO = Sorties completed IAW the original schedule
SCR = Sorties completed that were rescheduled from the original schedule
SCA = Sorties completed that were in addition to the original schedule
SS = Sorties on the original schedule
SR = Sorties on the original schedule, not completed for whatever reason) and rescheduled for the same day
SW = Sorties canceled due to weather prior to launch
SO = Sorties canceled for operational reasons

Additionally, ready for training aircraft and the material condition of the aircraft are indications of the Contractor's ability to provide contract-required maintenance. As indicated in Section H of the contract ready for training and material condition of the aircraft will be evaluated and reported. Performance incentive fee will be apportioned accordingly.

4.0 ORGANIZATIONAL LEVEL MAINTENANCE

The Contractor shall perform all organizational level (O-level) maintenance in accordance with this SOW to include those maintenance functions normally performed by an operating unit on a day-to-day basis in support of its mission and in accordance with OPNAVINST 4790.2 series.

TRANSIENT SERVICES

The Contractor shall perform transient line functions to include directing, parking, securing, aircraft fire guard, and assistance to flight crew for transient Tactical Air Warfare Program aircraft.

The Contractor shall provide transient maintenance services at Naval Air Station (NAS) Fallon and off-site detachments for an average of 3 transient aircraft per work day and up to 8 aircraft at any one time for any of the following T/M/S: F-14A; F/A-18A/B; E2C; SH-60/HH-60. The Contractor shall provide flight line services including launch and recovery, chocking, tie-down, refueling, and daily/runaround inspections when required by the Naval Aircraft Maintenance Program (NAMP). With the exception of other Navy Tactical Warfare NTAW aircraft maintained by the Contractor, transient aircraft maintenance is limited to normal flight line services. These shall include line troubleshooting and repairs, replacement of tire and wheels, replacement of Weapons Replaceable Assembly's (WRA) necessary for safe flight, component and assembly replacement and other maintenance not requiring a functional checkflight upon completion. Transient NTAW aircraft maintained by the Contractor at other sites shall be considered as assigned aircraft for maintenance purposes.

Contractor shall also provide the same transient services as listed in paragraph 4.1 above for F-14B/D and F/A-18C/D except as noted. The Contractor will not provide line troubleshooting and repairs, replacement of WRA's necessary for safe flight, and component and assembly replacement and any other maintenance requiring a functional check flight upon completion.

4.2 CORRECTIVE MAINTENANCE

The Contractor shall perform corrective maintenance IAW applicable aircraft and component maintenance manuals. Corrective maintenance procedures shall ensure uncorrected discrepancies are minimized, addressed and corrected as soon as practical.

4.3 DETACHMENTS

NSAWC aircraft will routinely deploy to other USN/USAF/USMC bases for unit training missions. Deployment bases/stations will provide the normal transient type servicing support (normally fuel and liquid oxygen). The Contractor shall provide all aircraft maintenance services contained in this contract (less security access and roving patrols) when detached to these bases, while still supporting flight operations at NAS Fallon, NV. Bases that NSAWC will routinely deploy to include:

LOCATION	#DETS/YEAR	#DAYS	#AIRCRAFT
MCAS MIRAMAR, CA	1	14	10-14
NAS LEMOORE, CA1		14	10-14
NAS OCEANA, VA	1	14	10-14
NAWC CHINA LAKE, CA	5	4	06-10

NAS KEY WEST, FL	1	14	10-14
NELLIS AFB, NV	1	14	10-16

Other bases that NSAWC will occasionally deploy to include: NAS JRB Fort Worth, TX; NAS NEW ORLEANS, LA; MCAS BEAUFORT, SC; MCAS CHERRY POINT, NC; and EILSON AFB, AK.

The above lists are representative and do not preclude NSAWC from detaching to other sites should the need arise or preclude surging above indicated aircraft numbers.

During certain periods NSAWC will detach to two or more sites simultaneously while continuing to operate at NAS Fallon, NV. Detachment schedules will be provided to the Contractor in advance when available. However, some detachments may be scheduled with short notice and require Contractor travel on weekends.

4.3.1 Detachment Support

The Contractor shall provide the support described in this contract for detachment support operations outside assigned station boundaries. In the event assigned aircraft are not mission capable at a location other than assigned station, the Contractor shall provide the necessary maintenance support. Travel/per diem shall be approved in advance by the COR.

Detachments and services shall be required in support of a combination of aircraft of various type/model/series. When Contractor personnel performing maintenance remain overnight at locations other than assigned station, per diem shall be paid at a rate not to exceed the rates specified in the Joint Travel Regulations (JTR). Personnel may utilize off base accommodations only when Government quarters are not available. Authorization for use of other than Government quarters must be covered by a certification of non-availability or justification by the COR. Reimbursement will be based upon JTR. Travel claims shall be completed and invoiced to the Government within 5 working days upon completion of travel.

(NOTE: The Contractor shall prepare and submit to the COR for approval "Invitational Orders" for all personnel authorized to perform off-site support. All travel shall be in accordance with the Joint Travel Regulations, Vol. II and OPNAVINST 11103.1.)

The following equivalency schedule shall apply to all personnel:

Site Manager - GS-13
Assistant site manager - GS-12
Leadmen/Senior Technicians - GS-9/GS-11
Mechanics - WG-8

When performing at a detached site, the Contractor shall replace at the detached site, at no cost to the Government, personnel who have voluntarily terminated, who have been terminated by the Contractor, or who have been removed from the detached site due to misconduct.

Travel and per diem costs incurred in the replacement and/or relocation of personnel will not be reimbursed when such replacement and/or relocation is accomplished for the Contractor or employee's convenience. Paid, itemized receipts shall substantiate invoices. At the Government's discretion, Government-furnished transportation may be provided in lieu of commercial transportation. Anticipate delays in excess of 4 hours 10% of the time when Government transportation is provided.

5.0 INTERMEDIATE MAINTENANCE

The Contractor shall manage Production Control and Maintenance Control functions separately. The Contractor shall perform nondestructive inspections: The Contractor shall provide Level II on site and have the ability to provide Level III on a temporary basis, for x-ray, eddy current, liquid penetrant, magnetic particle, and ultrasonic methods, as required, for assigned aircraft.

6.0 LIMITED DEPOT LEVEL MAINTENANCE

The Contractor shall provide limited D level maintenance support for the Naval Tactical Air Warfare Program. All limited D level maintenance shall be provided as an Over and Above action on a case by case basis. Examples of limited D level maintenance actions include modification, component repair, aircraft paint ((other than corrosion control), painting indoors other than corrosion control shall be performed in Government approved facility. This effort covered under optional CLIN), repair and/or replacement of airframe structural components/aircraft strain gauges, and integration/installation of various avionics modifications. The Contractor will uncan engines, place the engines on rails, and equip them with Quick Engine Change Kits (QECK) for the TF-30 engine. The Contractor may seek engineering support from non-Government sources with Government/TYCOM approval.

9.0 GOVERNMENT-FURNISHED MATERIAL, EQUIPMENT, AND PROPERTY

The Contractor shall manage Government Furnished Property in accordance with the Government Furnished Property Clauses contained in Section I of this contract, Federal Acquisition Regulations, Subpart 45, and other program requirements. These shall include but are not limited to, the IMRL Program, Tool Control Program, DEPOT Level Repairable Material Program, Plant and Minor Property requirements, and Navy Supply System regulations, instructions and directives.

The Contractor shall maintain site specific records of all Government Furnished Property per the requirements of FAR Subpart 45. The Contractor shall use and maintain an automated accounting system for accountability, tracking and inventory of all Government Furnished Property regardless of cost. This system shall be used for all Government Property except IMRL, which shall be tracked and accounted for using the Government Furnished IMRL Program. Contractor records are the official Government records in accordance with Federal Acquisition Regulations, Subpart 45. All Property CDRLs, including contract Phase out turn over records, shall be submitted in Stand Alone Material Management System (SAMMS).

a. The Contractor shall develop and submit, for Contracting Officer Approval, a Property Control Plan/System in accordance with FAR Subpart 45 and the property clauses identified in Section I of this contract. This Property Control plan shall incorporate the provisions and requirements of identified property instructions and directives for the accountability, control, use, protection, preservation, inventory, movement, disposition, and maintenance of Government Furnished Property. This Property Control Plan is required thirty days after contract award. Proposed changes to the plan must be submitted to the PCO for approval prior to implementation.

b. The Contractor shall be liable for loss or damage to Government furnished property in accordance with the Government Property Clauses contained in Section I of this Contract. In the case of loss or damage, the Contracting Officer shall determine the amount of the Contractor's liability. The Contractor shall verbally notify the COR within 24 hours of discovery of lost, damaged or destroyed Government Property and provide written notification within (5) workdays after verbal notification. The written report shall be in accordance with FAR 45 requirements for Lost, Damage or Destroyed (LD&D) Government Property. The Contractor shall also prepare and submit a Missing, Lost, Stolen and recovered (MLSR) Report per SECNAVINST 5500.4. The official property records shall be adjusted with an approved DD Form 200, Survey document for all loss or destroyed Government Furnished Property.

c. The Contractor shall dispose of Government Property per direction of the CORs and the Property Administrator. Government Property turned into Defense Reutilization and Marketing Office (DRMO) shall be documented and processed per DODINST 4160.2M and local Installation instructions.

REPORTING

The Contractor shall initiate and maintain a standard format of reports. These reports shall be submitted to the Government, as stated in Exhibit A of the contract.

e. Aircraft Status Report – The Contractor shall provide an Aircraft Status Report IAW CDRL, DD Form 1423, Item A005.

I. Daily Aircraft Readiness Status Report – The Contractor shall provide a Daily Aircraft Readiness Status Report IAW CDRL, DD Form 1423, Item A009.

APPENDIX E. 3RD AND 4TH GENERATION AIRCRAFT CHARACTERISTICS

F-5 Freedom Fighter		MiG-21 Fishbed	
Fighter		Fighter-interceptor	
Northrop		Mikoyan-Gurevich	
One		One	
$756,000		*N/A*	
Two General Electric J85s of 4,080 lbs. thrust each with afterburner		One Tumansky R-11F-300 rated at 12,675 lb (w/ afterburner)	
47 feet, 2 inches		51 ft, 8.5 in (15.76 m)	
25 feet 3 inches		23 ft, 5.5 in (7.15 m)	
13 feet 2 inches		13 ft, 5.5 in (4.10 m)	
8,085 lb		12,882 lb (5843 kg)	
20,677 lb		21,605 lb (9800 kg)	
925 mph (Mach 1.4) at 36,000 feet		Mach 2.05 (2175 km/h / 1,353 mph)	
50,500 feet		50,000 ft (15,250 m)	
with maximum fuel -- 1387 miles		600 nautical miles -- MiG-21bis	
Two 20-mm cannon in the fuselage nose; two AIM-9 Sidewinder at the wingtips; Five pylons carry up to 6200 pounds of ordinance or fuel tanks; loads can include four air-to-air missiles, Bullpup air-to-surface missiles, bombs, up to 20 unguided rockets, or external fuel tanks.		One twin-barrel 23 mm GSh-23 cannon with two K-13A Atoll AAMs, two AA-2C Atoll or rocket packs. 500kg and 250kg bombs on ground attack missions.	
United States	Norway	Russia	Kazakhstan
Bahrain	Philippines	Afghanistan	Laos
Brazil	Saudi Arabia	Albania (J-7)	Libya
Canada	Singapore	Algeria	Madagascar
Chile	South Korea	Angola	Mali
Ethiopia	Spain	Azerbaijan	Mongolia
Greece	Sudan	Bangladesh (J-7)	Mozambique
Honduras	Switzerland	Bulgaria	Migeria
Indonesia	Taiwan	Burma (J-7)	North Korea
Iran	Thailand	Cambodia	North Yemen
Jordan	Tunisia	China (J-7)	Pakistan (F-7P, J-7)
Kenya	Turkey	Congo	Poland
Libya	Venezuela	Croatia	Romania
Malaysia	Vietnam	Cuba	Slovakia
Mexico	Yemen	Czech Republic	South Yemen
Morocco		Egypt (F-7, J-7, MiG-21)	Sri Lanka
Netherlands		Ethiopia	Sudan (J-7)
		Finland	Syria
		Germany	Tanzania (J-7)
		Guinea	Uganda
		Hungary	Vietnam
		India	Yugoslavia
		Iran (J-7)	Zambia
		Iraq	Zimbabwe (J-7)

Appendix E. (continued)				
Specifications	**F/A-18 Hornet**	**Su-27 Flanker**	**SU-30 Flanker**	**MiG-29 Fulcrum**
Primary Function:	Multi-role attack and fighter aircraft	Air superiority fighter	Two-seat multirole fighter	Multi-role fighter
Contractor:	McDonnell Douglas	Sukhoi	Sukhoi	Mikoyan-Gurevich
Crew:	A: One; B:Two	One	1 pilot, 1 weapons systems officer	One
Unit Cost:	$29 million	*N/A*	$34 million	*N/A*
Powerplant	Two F404-GE-402 enhanced performance turbofan engines (17,700 pounds (8,027 kg) static thrust each)	Two NPO Saturn AL-31F turbofans each rated at 17,857 lb (79.43 kN) dry thrust and 27,557 lb st (122.58 kN) with afterburner	two Saturn/ Lyul'ka AL-31F afterburning turbofans, 55,114 lb (245.16 kN)	Two Klimov/Sarkisov RD-33 turbofans at 18,298 afterburning pounds of thrust each
Dimensions				
Length:	56 feet (16.8 meters)	71 ft, 11.5 in (21.935 m)	71.92 ft (21.94 m)	56 feet and 10 inches
Wingspan:	40 feet 5 inches (13.5 meters)	48 ft, 2.75 in (14.7 m)	48.17 ft (14.70 m)	37 feet and 3.25 inches
Height:	15 feet 4 inches (4.6 meters)	19 ft, 5.5 in (5.932 m)	20.83 ft (6.36 m)	15 feet and 6.2 inches
Weights				
Empty:	23,050 lb (10455 kg) -- F/A-18C	39,021 lb (17700 kg)	32,020 lb (17,700 kg)	24,030 pounds
Maximum Takeoff:	51,900 pounds (23,537 kg)	66,138 lb (30000 kg) -- Flanker-B	74,955 lb (34,000 kg)	40,785 lb (18500 kg) -- Fulcrum-A
Performance				
Speed:	Mach 1.7+	Mach 2.35 (1,553 mph; 2500 km/h)	1,320 mph at 32,780 ft, Mach 2.3	Mach 2.3 (1,520 mph)
Ceiling:	50,000+ feet	59,055ft (18,000m)	57,360 ft (17,500 m)	55,775 ft (17000 m) – Fulcrum-A
Range:	Combat: 1.089 nautical miles (1252.4 miles/2003 km), clean plus two AIM-9s; Ferry: 1,546 nautical miles (1,777.9 miles/2844 km), two AIM-9s plus three 330 gallon tanks retained	*N/A*	*typical:* 1,620 nm, ferry: 3,770 nm	932 miles (810 nm / 1500 km) with internal fuel – Fulcrum-A
Armament	One M61A1/A2 Vulcan 20mm cannon; AIM 9 Sidewinder, AIM 7 Sparrow, AIM-120 AMRAAM, Harpoon, Harm, SLAM, SLAM-ER, Maverick missiles; Joint Stand-Off Weapon (JSOW); Joint Direct Attack Munition (JDAM); various general purpose bombs, mines and rockets.	One 30 mm GSh-301cannon, up to 6,000 kg payload of missiles and bombs including AA-10 (Alamo) air-to-air missiles, AA-11 (Archer) air-to-air missiles, FAB-100	8,000 of weaponsone 30-mm GSh-301 cannon (149 rds) R-33/AA-9 Amos, R-27/AA-10 Alamo, R-73/AA-11 Archer, R-77/AA-12 Kh-29/AS-14 Kedge, Kh-31/AS-17 Krypton, Kh-59 free-fall, cluster bombs rocket pods, ECM pods	One 30mm GSh-301 cannon with 150 rounds, Six AAMs including a mix of SARH and AA-8 Aphid (R60), AA-10 Alamo (R27T), AA-11 Archer, (R73), FAB 500-M62, FAB-1000, TN-100, ECM Pods, S-24, AS-12, AS-14
KNOWN OPERATORS:	United States Australia Canada Finland Kuwait Malaysia NASA Spain Switzerland	Russia Belarus China Ukraine	Russia China India	Russia Malaysia Algeria Moldova Angola North Korea Belarus Peru Bulgaria Poland Croatia Romania Cuba Slovakia Czech Republic Syria Germany Turkmenistan Hungary Ukraine India Uzbekistan Iran Yemen Iraq Yugoslavia Kazahkstan

APPENDIX F. LIST OF ACRONYMS

AVDLR	Aviation Depot Level Repairable
CNO	Chief of Naval Operations
DOD	Department of Defense
FY	Fiscal Year
I-Level	Intermediate Level
MCAS	Marine Corps Air Station
NAS	Naval Air Station
NAVAIR	Naval Air Systems Command
NAVICP	Naval Inventory Control Point
NAVSUP	Naval Supply Systems Command
O-Level	Organizational Level
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 G. GLOSSARY OF TERMS

APPROPRIATION. An authorization established by an Act of the 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 hereafter.

AVIATION DEPOT LEVEL REPAIRABLE (AVDLR). These are the repairable spare parts that support naval aviation. Prior to April 1985 new repairable spares were purchased from the appropriation procurement account, repairable items were reworked by the depot maintenance activities and financed by an O&M, N account, and not charged against the FHP. These spares were issued at no cost to the operating commands. Under the current system, aviation commands purchase AVDLR replacement parts from the stock fund using funds budgeted for in the Operating Target Functional Category (OFC)-50 budget.

AVIATION DEPOT LEVEL REPAIRABLE (AVDLR) COST: Identifies the sum of the reported Aviation Depot Level Repairable (AVDLR) cost for the reported WUC. AVDLR costs pertain to repairable items that are removed at the intermediate level of maintenance and sent as a BCM to the depot for repair. The AVDLR Cost for a particular 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 NAVAL AIR FORCE RESERVE. The Naval Air Force Reserve is VFC-13's TYCOM and is commanded by a Rear Admiral and is headquartered in New Orleans, La. Today's Naval Air Force Reserve had its genesis in 1946 with the establishment of the Naval Air Reserve Training Command, headquartered at Naval Air Station Glenview, Ill. 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 within 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 Consumable Price File. The Standard Price is comprised of two components: the Replacement Price, which is the Price that NAVICP or DLA pays

the contractor for a new part; and the Cost Recovery Rate, which is the cost of supply system operations.

CREW. As utilized for OP-20 and FHP purposes, a crew is the number of pilots required to fly an aircraft. For a single-piloted aircraft such as the AV-8B or the F-4, a crew is one pilot. For a dual-piloted aircraft such as the CH-46 or KC-130, a crew is two pilots. (The crew of an A-6 is 1 pilot.)

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 any other tasks as designated by the President and Congress.

FISCAL YEAR (FY): The Fiscal Year corresponds to the annual budget and appropriations schedule, and reflects the period defined by the calendar dates 1 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 aggregate 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 force units are assigned to this program)
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 or damaged or unserviceable parts, components, or non-available parts: and provisions of technical assistance to using organizations.

MAJOR CLAIMANT. Bureau, office, or command (e.g., CINCLANTFLT and CINCPACFLT) designated as an administering office under the operation and maintenance appropriation which receive operating budgets directly from the CNO.

NAVAL AIR SYSTEMS COMMAND (NAVAIR): One of five Navy systems 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 within the Naval Supply Systems Command (NAVSUP), one 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.

O-LEVEL MAINTENANCE ACTIVITY: Organizational maintenance (O-level) is the lowest level of maintenance performed on aircraft. It is squadron-level activity, and includes inspecting, servicing, lubricating, and replacing WRAs.

OFC. A system whereby the various categories of O&M,N 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 TMS, which is used for FHP funding and fleet planning. Requirements are computed by using historical data and 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. Also see enclosure (3) for detailed methodology.

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 (POL) used in intermediate and organic maintenance of aircraft, AVDLR and non-AVDLR material used in direct organic maintenance of aircraft. AFM is one of three components of OP-20 Cost Per Hour (CPH). See NAVSO P-3013-2 for detailed listing.

TYCOM. An intermediate level of command which is directly subordinate to the Fleet CINC. Financial authority is issued by major claimants (Fleet CINC) to TYCOM's in the

form of expense limitations. Amounts therein are available for issuance of operating budgets, and from operating budgets, issuance of OPTAR's.

TMS. The specific designation of aircraft used by the military and used by the DON FHP for planning and funding. Type refers to the mission of the aircraft, such as attack (A), fighter (F), etc. Model refers to the particular airframe in that mission category, such as an A-4 or F-4. The series is a particular configuration within the model, such as an A-4E or A-4M, or an F-4N or F-4S. The series indicates equipment that is installed on board that gives it individual mission or performance capabilities. In most cases, the higher the letter designator - the newer the series. This is not always true such as in the case of the CH-46E which followed the CH-46F series.

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.

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
   Ft. Belvoir, Virginia

2. Dudley Knox Library
   Naval Postgraduate School
   Monterey, California

3. Donald R. Eaton
   Naval Postgraduate School
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4. Kevin R. Gue, PhD
   Naval Postgraduate School
   Monterey, California

5. Mary A. Malina, PhD
   Naval Postgraduate School
   Monterey, California

6. Jeffrey C. Brown
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