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ECONOMIC ANALYSIS FOR AN F-22 ORGANIC VS. CONTRACTOR AIRCRAFT BATTLE DAMAGE REPAIR OWNERSHIP DECISION

THESIS

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THESIS

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Captain, USAF

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John A. Kitchens

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List of Acronyms

ABDAR	Aircraft Battle Damage Assessment and Repair
ABDR	Aircraft Battle Damage Repair
ACC	Air Combat Command
AFB	Air Force Base
AFDP	Award Fee Determining Plan
AFI	Air Force Instruction
AFIT	Air Force Institute of Technology
AFLMA	Air Force Logistics Management Agency
AFMC/LGM	Air Force Materiel Command Maintenance Division
AFMCI	Air Force Materiel Command Instruction
AFSC	Air Force Specialty Code
ALC	Air Logistics Center
ATF	Advanced Tactical Fighter
BDR	Battle Damage Repair
BOS	Base Operating Support
CA	Commercial Activity
CA/RP	Custody Authorization/Receipt Products (R14)
CLFF	Combat Logistics Force Fleet
CLS	Contractor Logistics Support
CLSS	Combat Logistics Support Squadron
CMB	Visibility and Management of Operations and Support Costs Command Code For Air Combat Command
CONOPS	Concept of Operations
CORE	Cost-Oriented Resource Estimating Model
CS	Combat Support
CSS	Combat Service Support
D+1	One day after the unnamed day on which a particular operation commences or is to commence. D-Day is *the* unnamed day on which a particular operation commences or is to commence.
DF	Depot Fixed
DFR	Depot Field Requirements
DFT	Depot Field Team
DoD	Department of Defense
DoDD	Department of Defense Directive
DODI	Department of Defense Instruction
DSB	Defense Science Board
E-E	Emergency Essential
ETF	Expected Team Factor
FAM	Functional Area Manager
FY	Fiscal Year

GAO	General Accounting Office
HQ USAF	Headquarters United States Air Force
ILS	Integrated Logistics Support
IOC	Initial Operation Capability
IS	Indirect Support
JSF	Joint Strike Fighter
LCC	Life-Cycle Costs
LOGCAP	Logistics Civil Augmentation Program
MAJCOM	Major Command
MDS	Mission Design Series
ME	Military Essential
MOOTW	Military Operation Other Than War
MP	Military Personnel
NFAF	Naval Fleet Auxiliary Force
O&S	Operations and Support
ODS/DS	Operation Desert Shield/Desert Storm
OMB	Office of Management and Budget
OTS	Officer Training Squadron
PACAF	Pacific Air Forces
PAW	Percent At-War
POL	Petroleum, Oil, and Lubricants
QDR	Quadrennial Defense Review
RADS	Rapid Area Distribution Support
RAM	Rapid Area Maintenance
ROM	Rough Order of Magnitude
ROTC	Reserve Officer Training Course
SECDEF	Secretary of Defense
SM-ALC	Sacramento Air Logistics Center
SMAMA	Sacramento Air Material Area
SPO	System Program Office
TINA	Truth in Negotiations Act
TRADOC	Army Training and Doctrine Command
UCMJ	Uniform Code of Military Justice
UMD	Unit Manning Document
US	United States
USAF	United States Air Force
USAFA	United States Air Force Academy
USAFA/FM	USAF Academy Financial Management Department
USAFE	United States Air Forces Europe
USC	United States Code
USNS	United States Navy Ship
UTC	Unit Type Code

VAMOSC	Visibility and Management of Operations and Support Costs
WCF	War Cost Factor
WR-ALC	Warner Robins Air Logistics Center

Abstract

The purpose of this study was to evaluate whether Contractor Logistics Support (CLS) is a viable alternative to Combat Logistics Support Squadrons (CLSSs) for providing F-22 Aircraft Battle Damage Repair (ABDR). Legalities, practicalities, and cost-effectiveness were key ownership concerns.

United States Code, Office of Management and Budget, Department of Defense (DoD), and United States Air Force (USAF) requirements were reviewed to address legal and policy issues and whether F-22 ABDR is military essential. The Army's Logistics Civil Augmentation Program (LOGCAP) award fee history was used to assess the potential performance of F-22 ABDR CLS personnel. F-117 ABDR team requirements and costs were used to estimate F-22 CLSS costs.

Results show DoD must decide if F-22 ABDR is a core logistics function and the USAF must determine F-22 ABDR requirements before outsourcing legality is clear. However, DoD civilian reliance continues today, and LOGCAP experiences attest that contractors consistently meet or exceed all clearly stated requirements. Analysis found that CLSS will provide higher combat readiness; although, CLS may provide slightly less combat readiness, but for potentially less cost. A dual approach, using a mixture of CLSS and CLS, could provide the most effective capability in terms of both combat readiness and cost.

ECONOMIC ANALYSIS FOR AN

F-22 ORGANIC VS. CONTRACTOR AIRCRAFT BATTLE

DAMAGE REPAIR OWNERSHIP DECISION

1. Introduction

General Issue

The F-22 Raptor is scheduled to replace the F-15 as the primary United States Air Force (USAF) air superiority fighter. Being developed by the Air Force, Lockheed Martin, Inc., and the Boeing Company, the F-22 will employ state-of-the-art technology that will ensure USAF pilots dominate the skies for decades to come. The F-22 program is presently in Engineering and Manufacturing Development (EMD), with Initial Operational Capability (IOC) scheduled for 2004. However, the planning, programming, budgeting, and implementation of important weapon system decisions will need to be coordinated well in advance of IOC. One very critical decision is whether to use Contractor Logistics Support (CLS)—civilian contractors—or USAF Combat Logistics Support Squadrons (CLSSs)—active duty military personnel—for the F-22 Aircraft Battle Damage Repair (ABDR) function. This decision might have been a very simple one as recently as five or 10 years ago; however, with increased congressional and executive pressure on Department of Defense (DoD) agencies to reduce their budget,

outsourcing must now be considered as a viable option. The Secretary of Defense (SECDEF), William S. Cohen, recently stated that:

> right now there is too much fat in the tail [the support structure or infrastructure]. Our infrastructure is still too large for our force structure today. Our purchasing system is still too cumbersome. Our logistics system has too many people. We still do too many things in-house . . . (Cohen, 1997)

The degree of congressional focus on this subject is apparent from a recent General Accounting Office (GAO) report titled, *DoD Force Mix Issues: Greater Reliance on Civilians in Support Roles Could Provide Significant Benefits.* The GAO made numerous observations concerning how broad DoD guidance allows use of military personnel in support positions. Here are some excerpts of the report:

- No single directive explained how DoD's "total force" policy should be implemented or the specific criteria to use in determining the appropriate mix of personnel. Therefore, because of the broad nature of the guidance, tradition, and cultural preferences, DoD and the services often merely maintain the status quo on military incumbency.

- In the case of support positions which may be appropriate for civilians to fill, the service regulations still tend to give greater emphasis to military incumbency.

- Army Regulation 570-4, "Manpower Management", . . . states that all support positions will be military if they have tasks that, if not performed, could cause direct impairment of combat capability. However, this does not reflect current Army operations . . .

- Informally, DoD and service officials have often cited probable deployability to theaters of operations in wartime as a basis for maintaining military incumbency. However, this position does not reflect current practice, since thousands of civilians were deployed to the Persian Gulf War. (GAO 95-5, 1994)

In light of this attention, USAF planners cannot simply apply current ABDR Concept of Operations (CONOPS) to the F-22 weapon system; manning decisions for military incumbency will likely become harder to justify. Instead, the ABDR decision-maker must systematically address the CLS alternative, and address the numerous issues which exist across the spectrum in this ABDR ownership decision. How practical or legal is using civilians for military support functions during hostile conditions? Are civilian contractors capable of doing ABDR maintenance, and can they be relied on during hostile conditions to perform their requirements up to USAF standards? And, which ABDR ownership strategy will be most cost-effective? These are crucial questions which the appropriate decision-maker will need to answer before making the F-22 ABDR ownership decision.

Purpose of the Study

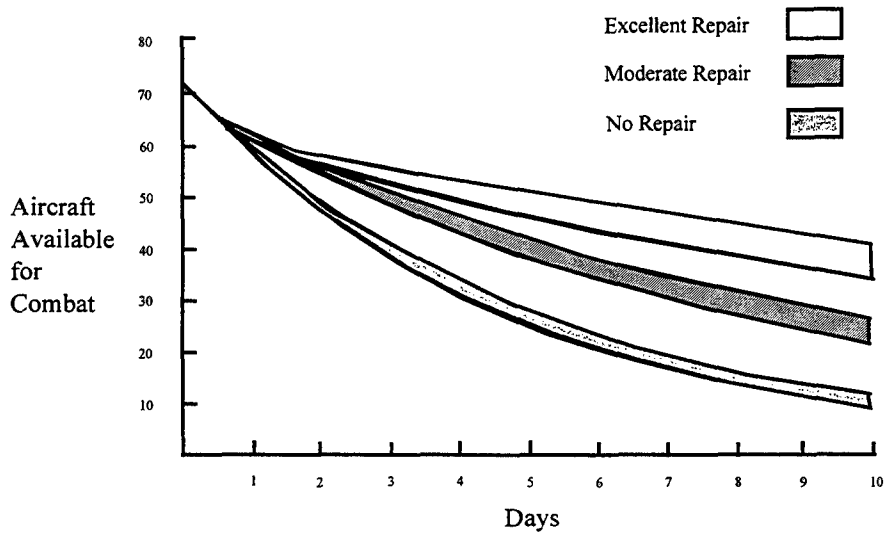
The purpose of this study is to evaluate crucial ABDR ownership questions in order to determine whether CLS is a viable alternative to CLSSs for providing the F-22 ABDR function and provide a recommendation for which alternative is best for the USAF.

Background

ABDR

Aircraft battle damage repair is a force multiplier which contributes to the maximum generation of sorties for ultimate combat mission effectiveness. Figure 1 illustrates how ABDR repair capabilities can increase aircraft availability for sortie

generation in a wartime scenario. Notice how an excellent repair capability (defined as returning 50 percent of the damaged aircraft to combat in 24 hours and 80 percent in 48 hours) can quadruple the number of available aircraft after only 10 days of combat (Srull, Simms, & Schaible, 1989). Since the USAF will procure far fewer F-22s than in a typical fighter acquisition—339, as of the May 1997 Quadrennial Defense Review—the most effective ABDR solution must be provided to ensure aircraft availability is maintained for the warfighter.



Source: Srull, Donald W., Edward D. Simms, Jr., and Raymond A. Schaible, Battle Damage Repair of Tactical Weapons: An Assessment, Report RE801R1 Logistics Management Institute, Bethesda, Md. August 1989 (AD-A213117)

Figure 1. Aircraft Attrition Rates With Varying Repair Capability

While the F-22's advanced technologies (such as low observable, fiber optic, and composite technologies) will provide it air superiority, the same technological enhancements will also make ABDR tasks exceedingly more difficult. In fact, one recent report stated that "the time needed for maintenance on low-observable systems is

excessive . [and] low observable [maintenance] equals 38 percent of maintenance man-hours per flight hour" (Walsh, 1997). As a result, current ABDR CONOPS are no longer sufficient, and whether to use CLSS teams or CLS becomes an even more paramount issue in deciding future F-22 ABDR strategies.

CLSSs

What exactly are Combat Logistics Support Squadrons? CLSSs have been mainstays of the USAF ABDR program function for many years now. Their wartime mission is to provide worldwide-deployable Air Force teams to perform the entire spectrum of ABDR and assist the organizational level in performing routine and unexpected, standard and heavy maintenance. The 653rd CLSS, stationed at Warner-Robins AFB SC, performs ABDR for the F-15. The squadron mission statement reads:

> The mission of the 653rd Combat Logistics Support Squadron is to provide highly trained, worldwide deployable military teams to accomplish ABDR and augment supply and surface freight management operations. This mission is enhanced by performing depot level maintenance, crash recovery/damage repair, limited standard base supply system operations, and rapid area distribution support (RADS), to include warehousing, rewarehousing and special logistics projects at the Warner Robins Air Logistics Center and Department of Defense units as directed.

When not deployed, CLSS personnel assist the Air Logistics Center (ALC) product directorates in performing depot-level maintenance and aircraft modifications at the co-located depot. In addition, the CLSS teams maintain and develop proficiency in ABDR by training in specific technical areas (e.g., composites and fiber optics), accomplishing depot field requirements (DFRs) at temporary duty locations and participating in local ABDR exercises. The CLSS ABDR team training is often

accomplished under simulated wartime conditions, including performing composite and fiber optic repairs while wearing full chemical protective gear. Because the CLSS teams are located at the aircraft depots, they develop the heavy maintenance and trouble-shooting skills necessary for the battle damage repair function; organizational level maintainers do not have these same skills. Presently, there are 11 CLSSs. Both an active duty and reserve CLSS are stationed at the five Air Logistics Centers, while one reserve CLSS operates from Wright-Patterson Air Force Base (AFB), Ohio.

Civilians in Hostile Zones

While these CLSS teams are now made up of military personnel, this has not always been the case for battle damage repair (BDR) of DoD resources. In fact, Rapid Area Maintenance (RAM) teams, made up of mostly noncombatant civilians, repaired more than 1,000 aircraft during the course of the Vietnam war (Diamond & Luther, 1990). As Darrell H. Holcomb put it, "[these mostly civilian teams] are the historical precursors of our current battle damage repair teams" (Holcomb, 1994). Other examples of the United States using civilians for support during hostilities span from the Revolutionary War, when General George Washington employed 600 civilian drivers to transport supplies (Epley, 1990), to Operation Desert Shield/Desert Storm (ODS/DS), when 36 contractor personnel went into Iraq during the ground war (Dibble, Horne, & Lindsay: 2-5). From these examples, it is clear that the precedent of using civilians in hostile theaters exists.

Despite precedence, the current opinion on using civilians for typically military functions is divided, providing another complicating factor in this ownership decision. In 1982, the Defense Science Board (DSB), chaired by Norman R. Augustine, studied the effectiveness of contractor employees. The DSB found that "contractor employees have an outstanding record of reliability during crisis and actual combat" (Condrill, 1993). This confidence in contractor employees persists even today. Paul E Taibl, Director of Economic Security Programs for Business Executives for National Security, a nonpartisan think tank, commented that

> During Desert Storm we saw that many of the risks that the military associated with contractor support failed to materialize. When those weapons [During the Persian Gulf conflict, contractor personnel were deployed with weapon systems such as the M-1 tank, Apache helicopter, and F-15 fighter aircraft (Kitfield, 1997)] went to war, the contract personnel went right along with them. When national security is at stake, people step up to the task. (Kitfield, 1997)

DoD now employs contractor personnel in as unlikely a place as a Navy submarine (Kitfield, 1997).

Contractor reliance also has its opponents, however. Traditionally, the services felt that "the demands of wartime were considered too imperative to rely on the vagaries of the marketplace, where suppliers sometimes go out of business . . . and even sometimes refuse direct orders" (Kitfield, 1997). For these reasons and others, the Office of Management and Budget (OMB) requires that certain *inherently governmental functions* be accomplished only by military personnel (OMB, 1983). While most functions in the military these days are being critically evaluated for possible outsourcing to civilian contractors, these inherently governmental functions must be owned and

operated by the military. The quandary: as government budgets have become more and more constricted, outsourcing has sometimes proven to save scarce budget dollars (GAO 97-86, 1997). Unfortunately, for many ownership decisions, DoD and the Services often merely maintain the status quo for military incumbency. This "do it as its always been done" approach precludes evaluation of a more cost-effective alternative. Instead, a systematic approach to the F-22 ABDR ownership decision should be taken.

Specific Problem

What ABDR ownership strategy, between CLS and CLSSs, would best serve the USAF? In investigating this problem, what justification exists for using contractor personnel for F-22 ABDR, and how would the two ownership strategies compare economically?

Investigative Question Set 1 - Justification For CLS

Before beginning any cost estimates for the CLS and CLSS alternatives, justification for even considering civilian contractors must be evaluated. In evaluating for justification, the following investigative questions must be addressed:

1. Does the law preclude using contractor civilians for F-22 ABDR?
2. Is ABDR considered an *intrinsically governmental function*, thus, off limits to outsourcing?
3. Do DoD or USAF manning criteria preclude use of contractor civilians for F-22 ABDR?

4. When the United States Air Force is directed into combat, would CLS civilians remain on duty during hostilities, and would their performance be up to Air Force standards?
5. What are DoD's future priorities, and how do they apply to the ABDR ownership decision?

Investigative Question Set 2 - Economic Analysis of Alternatives

If there is enough justification for using contractors, the following economic analysis questions need to be addressed:

1. What ABDR cost elements exist which should be included for cost analysis of how using CLS vs. CLSSs compares financially?
2. How would CLS and CLSS ownership strategies compare financially?

Summary

The F-22 Raptor ABDR function must be developed so that sortie generation rates can be maximized during any future contingency or war. The cost-effectiveness of the ABDR approach taken is extremely important as well. Defense budget officials state that unnecessarily diverting scarce money resources will adversely effect our capability to modernize our forces, ultimately leading "to a decline in military readiness and combat power" (Maze, 1997). As a result, when developing a means to provide the ABDR function, alternatives must be considered and an economic analysis conducted. This chapter presents pertinent investigative questions as a means for deciding the most effective F-22 ABDR concept.

Chapter 2 will evaluate the questions in Investigative Question Set 1. In doing so, various US laws and government regulations will be presented and analyzed. Also, past DoD use of civilians during hostilities and present plans for the same will be explained. The contradictions which exist between, a) past use and present plans, and b) present policies will be discussed. Finally, the reasons for justifying outsourcing and the implications which could exist will be explained.

Chapter 3 will provide an overview of economic analysis, as it pertains to the F-22 ABDR ownership decision; subsequently, the methodology for costing the base case—using CLSS teams for F-22 ABDR—will be presented. In conducting this economic analysis, a cost estimating model will be used as a guide which will help provide structure to this study, facilitating base case calculations. Subsequently, pertinent cost categories and elements will be described, along with the data used for costing these categories. In addition, assumptions will be given. The primary purpose of this chapter is to prepare the reader for the detailed cost analysis which appears in Chapter 4.

Chapter 4 will provide detailed analysis of all category costs for the base case, followed by a final estimate for CLSS costs. In addition, potential major cost drivers for CLS will be submitted, using both the base case and an analogous DoD CLS program called the Logistics Civil Augmentation Program (LOGCAP). Although prediction of wartime costs isn't an objective, this study will illustrate potential cost scenarios which could exist if and when the USAF must deploy ABDR teams to a hostile zone. Before analyzing the category costs, a discussion on total costs and F-22 logistics support will be provided.

Chapter 5 will present conclusions, recommendations for the F-22 ABDR ownership decision, and suggested future research.

2. Justification For CLS

Introduction

This chapter provides key definitions needed to understand both legal and practical implications of outsourcing military functions and this study's approach to answering the ABDR ownership decision. Subsequently, the following relevant issues will be discussed: US Code, OMB, and DoD criteria which must be met in order to outsource military functions, and Air Force implementation of these criteria; precedence DoD agencies have set by past use of civilians in combat environments; and whether or not outsourcing the F-22 ABDR function can be justified. Finally, potential benefits and shortcomings from using contractors are explored.

When answering whether or not CLS is a viable alternative to using a CLSS for the F-22 ABDR function, this study maintained a focus on three key concerns: (1) Could contractor personnel effectively do the required maintenance, (2) could they handle the environment in which they would be performing the maintenance, and (3) could they arrive in time to be an effective force-multiplier? When addressing these issues, pertinent real world examples of both DoD civilians and contractor personnel will be given. First, how this study uses civilians and contractor personnel must be explained.

Civilians and Contractor Personnel

While there are differences between DoD civilians and contractor personnel, this study will use them interchangeably when discussing the viability and justification of

using a "civilianized" approach to providing ABDR. The rationale is that neither DoD civilians nor contractor personnel are military personnel, as the CLSS personnel are. As a result, reliance on either as an option to CLSS personnel provides very similar risks. Will they remain in a theater of operations during very tense moments? Will they follow orders without question? Will they eagerly attempt to synergize with the military units they are assigned with? Will they be limited by a job description or written contract? These questions are pertinent, and they apply to both DoD civilians and contractor personnel. Whether DoD civilians would be more amenable to military objectives during hostilities is uncertain. However, many contractors employ prior-military individuals who also have served their country in time of need. In fact, Dyncorp, the new LOGCAP prime contractor, estimates that 95% of their personnel are prior military (Eby, 1997). Consequently, much of the information in this chapter refers to either DoD civilians or contractor personnel.

Key Definitions

To facilitate the understanding of Congressional and Executive outsourcing criteria and precedence set by DoD agencies, the following key terms are defined: inherently governmental function, commercial activity, military essential, emergency-essential civilian position, essential contractor service, and Vital Defense Systems and Associated Support Activities.

Inherently Governmental Function

OMB's Circular No. A-76 states that "Certain functions are inherently Governmental in nature, being so intimately related to the public interest as to mandate performance only be Federal employees." The circular explains that these functions, are not in competition with the private sector, thus, can be accomplished by government employees.

Commercial Activity (CA)

An activity operated by a federal executive agency which provides a product or service which could be obtained from the private sector (OMB, 1983).

Military Essential

Defined in Air Force Instruction (AFI), *Determining Manpower Requirements*, as

> positions that directly contribute to prosecution of war (combat or direct combat support), exercise Uniform Code of Military Justice authority, are required by law, are military due to custom or tradition, are needed for overseas rotations, or require a skill not available in civilians resources. Other workloads are not military essential and should be performed by in-service civilians or contract services. (AFI 38-201, 1994)

Emergency-Essential Civilian Position

Defined in DoD Directive (DODD) 1404.10, *Emergency-Essential (E-E) DoD U.S. Citizen Civilian Employees*, as

> . . . a civilian position located overseas or that would be transferred overseas during a crisis situation or which requires the incumbent to deploy or to perform temporary duty assignments overseas during a crisis in support of a military operation. That position is required to ensure the success of combat operations or to support combat-essential systems subsequent to mobilization, an evacuation order, or some other type of

military crisis. That position cannot be converted to a military position because it requires uninterrupted performance to provide immediate and continuing support for combat operations and/or support maintenance and repair of combat-essential systems. (DODD 1404.10, 1992)

Essential Contractor Service

Defined in DoD Instruction (DODI) 3020.37, *Continuation of Essential DoD Contractor Services During Crises*, as

> . . . a service provided by a firm or an individual under contract to the DoD to support vital systems . . . and associated support activities considered of utmost importance to the U.S. mobilization and wartime mission. These services are essential because DoD components may not have military or DoD civilian employees to perform these services immediately and the effectiveness of defense systems or operations may be seriously impaired, and interruption is unacceptable when those services are not available immediately. (DODI 3020.37, 1990)

Outsourcing

> Government reliance on the private sector to provide recurring services known as commercial activities. It is a tool to use in managing resources and achieving efficiency and possibly cost savings. (AFLMA, 1996)

Vital Defense Systems and Associated Support Activities

When defining this, DODI 3020.37 includes: (1) Selected operational weapons systems, including those being brought into the DoD inventory, and (2) Operational logistics support of [vital systems] . . . and other wartime services if determined vital to mission continuance by the Component Commander (DODI 3020.37, 1990).

What *Can* be Outsourced?

With the drastic budget cuts DoD has encountered recently, outsourcing is increasingly gaining acceptance as a way for DoD agencies to save dollars. Just recently,

Brigadier General Timothy P. Malishenko, the Deputy Assistant Secretary for Contracting, wrote that "outsourcing is one of our top Operational Contracting Priorities (AFLMA, 1996)." While outsourcing has had some successes, it is important to understand that certain military functions simply *cannot* be outsourced. DoD agencies must meet various legislative, OMB, DoD, and USAF criteria before even considering whether outsourcing might be a viable alternative.

Legislative Criteria

The United States Code, Title 10 (10 USC), Section 2464, *Core Logistics Functions*, states that:

> . . . it is essential for the national defense that DoD activities maintain a logistics capability to ensure a ready and controlled source of technical competence and resources necessary to ensure effective and timely response to a mobilization, national defense contingency situations, and other emergency requirements. (10 USC Sect. 2464, 1997)

The SECDEF is instructed to identify which DoD activities are core (10 USC, Sect. 2464, 1997). At the same time, however, 10 USC Sect. 2462, *Contracting for Certain Supplies and Services When Cost is Lower,* states that:

> . . . except as otherwise provided by law, the Secretary of Defense shall procure each supply or service necessary for or beneficial to the accomplishment of the authorized functions of the DoD (other than functions which the Secretary of Defense determines must be performed by military or government personnel) from a source in the private sector if such a source can provide such supply or service to the Department at a cost that is lower . . . (10 USC Sect. 2462, 1997)

As a result, according to the US Code, an organization *should* outsource an activity if the private sector is less expensive, unless law prescribes or the SECDEF declares that the function must be done by the military.

OMB Criteria

The OMB allows for outsourcing of functions which are not inherently governmental or military essential. While the military essential determination is left up to DoD, interpretation of the OMB's A-76 Circular could place ABDR in one of the two categories which governmental functions typically fall into—the *act of governing*. This category includes "activities performed exclusively by military personnel who are subject to deployment in a combat, combat support [CS], or combat service support [CSS] role (OMB, 1983)." Unfortunately, the fact that civilians have deployed in CS and CSS roles (GAO 95-5, 1994) makes the OMB's deployment criterion questionable. Does the circular include all forces which could be deployed, from *D +1* on; or, is the intention merely to establish governmental control of forces scheduled to deploy within the initial 24, 48, 72, 96, . . . hours?

In addition to the questionable deployment criterion, the exclusively military criterion is also suspect. If a function already includes *other-than* military personnel who perform "activities. . . subject to deployment in a . . . or combat service support role," it appears that the function is considered open to outsourcing. Unfortunately, this definition creates a paradox: If the function already includes other-than military personnel, it can be outsourced; however, if only military personnel presently perform the function, it cannot

be outsourced. The question then becomes which comes first when considering a function for outsourcing? Because of the paradox, two distinct DoD functions probably exist —within two different services—which are considered as open to outsourcing, and not open to outsourcing by the OMB criteria.

Obviously, all services have in the past and presently do deploy contractors into hostile areas; as a result, ABDR would appear to be open to outsourcing. Interestingly, the A-76 Circular does list aircraft maintenance as a CA (OMB, 1983). It appears that the question now becomes whether the function is military essential, a determination that the DoD must make.

DoD Criteria

In defining what functions can be outsourced, the US Code and OMB Circular allow significant latitude in interpretation. The Department of Defense has been more restrictive when laying down guidance for the individual agencies. According to DoD guidance, civilian personnel will be used in positions (1) which do not require military incumbents for reasons of law, training, security, discipline, rotation, or combat readiness, (2) which do not require a military background for successful performance of the duties involved, and (3) which do not entail unusual hours not normally associated or compatible with civilian employment (DODD 1100.4, 1954). In light of these criteria, it would seem that DoD managers cannot possibly decide to outsource any activity remotely similar to a CS or CSS function. However, the GAO reported that civilians do serve in these functions, contrary to the guidance given by DoD regulations.

USAF Policy on Outsourcing ABDR

The USAF policy is based on DoD policy, but, provides additional limiting criteria. So, what is the effect on the F-22 ABDR outsourcing decision? The answer depends on whether ABDR is considered either a *direct* combat support or *indirect* combat support function. According to AFI 38-204, *Programming USAF Manpower*, if a position requires that an incumbent perform combat or direct CS, manning officials are directed to authorize that position as military (AFI 38-204, 1994). Subsequently, the AFI uses aircraft and aircraft systems maintenance as examples of positions which require an individual to support direct combat (AFI 38-204, 1994), thus, giving impetus for declaring ABDR a direct CS function and military essential (ME), as has been done in the past. However, F-22 ABDR is likely to require a much different CONOPS than typical Mission Design Series (MDSs). This is because the complex technologies designed into the F-22 could change the entire ABDR strategy. To return the F-22 low-observable signature to full mission capability may require removing the aircraft completely away from the area of operations. If this were true, would F-22 ABDR still be considered direct CS, or, would the USAF then consider it an indirect CS function? If the determination is to make F-22 ABDR an indirect CS function, manning officials will have to work with USAF written guidance which is vague and contradictory.

For indirect CS functions, AFI 38-204 gives four different answers for making the manning determination on indirect CS functions. The following four excerpts from the AFI highlight the lack of clear guidance and contradictions:

- **Paragraph 6.1.2.** *Use of Nonmilitary Personnel.* For indirect combat support, use in-service civilian employees or contract services.

- **Paragraph 6.3.1.** *Nonmilitary Work.* Use in-service civilian employees or contract services to perform work not requiring military personnel.

- **Paragraph 6.4.2.1.** *MES Code A, bullet 8.* Designate as military essential those positions that are indirect combat support positions tasked by a HQ USAF-approved contingency or war plan.

- **Table 6.1.** *How to Determine Military Essentiality, Rule 9.* If position supports indirect combat when use of volunteer civilian employees is deemed unreasonable (e.g., administrative specialist at an operating location) or is tasked against a UTC [unit type code] to support an OPlan providing probable exposure to hostile fire, then authorize [the position] as military. (AFI 38-204, 1994)

These four directions clearly do not explain how to man an indirect CS function. The first one explicitly says to use in-service civilians or contractor services. This paragraph follows immediately after paragraph 6.1.1., *Use of Military Personnel*, which affirms the DoD policy to assign military personnel only to positions that (1) directly contribute to prosecution of war (combat or direct combat support), (2) are military by law, (3) are military by custom or tradition, or (4) are needed for overseas rotation. However, the AFI then begins to place caveats on when to use civilians or contractor personnel for indirect CS functions. The second direction says the same as the first, but, only if the function does not require military personnel. How does a manning official determine when a function requires a military individual? The third direction is even more restrictive, explaining that ME positions are those that "are indirect combat support positions tasked by a HQ USAF-approved contingency or war plan." This caveat ignores the fact that civilians *are* integrated with Air Force and Major Command (MAJCOM)

contingency and wartime planning and execution (AFI 36-507, 1994). Finally, the fourth direction explains that ME is required if using civilians is unreasonable or the position is tasked against a UTC to support an OPlan providing probable exposure to hostile fire. Unfortunately, the last direction requires a judgment call be made by the manning official, who faces many unanswered questions. Can this official say whether or not the F-22 ABDR function will require civilians to be under probable hostile fire? What probability of civilians being under hostile fire would be enough to warrant making F-22 ABDR ME?

Assuming there are certain indirect CS positions USAF officials do not want civilians used for, the requirement for when to make an indirect CS function ME is most clearly explained in paragraph 6.4.2.1. However, there is a problem with this criterion. AFI 36-507, *Mobilization of the Civilian Work Force*, instructs MAJCOM's to:

- make sure that enough qualified civilian employees are available to meet worldwide mission requirements during a national emergency, mobilization, war, military crisis, or other contingency,
- integrate civilian work force, Air Force, and MAJCOM contingency and wartime planning and execution, and
- document that a sufficient number of qualified employees will be available to meet worldwide mission requirements. (AFI 36-507, 1994)

Not only are there contingency and wartime plans which are integrated with the civilian workforce, but, one of the USAF's planning assumptions for AFI 36-507 is that "units continue to use civilian employees in indirect combat support (noncombatant) positions that need not be filled by military members" (AFI 36-507, 1994). So, are these civilians

who are integrated into wartime planning also considered tasked by a HQ USAF-approved contingency or war plan?" Regardless, USAF guidance has made the determination for F-22 ABDR very difficult, where any answer could be justifiably questioned.

When considering the previous discussion, it is important to remember that "[USAF] policy is to outsource functions known as CAs only when it is deemed cost-effective and *results in no degradation of mission* (AFLMA, 1996). If ABDR is deemed not an intrinsically governmental function, ABDR would be considered a CA, by definition. Consequently, if using CLS proves most cost-effective *with no mission degradation*, outsourcing would be the choice here because F-22 ABDR would not be ME. As for the F-22 ABDR function, MAJCOM Functional Area Managers (FAMs) are instructed to "determine military essentiality on the basis of the requirements of the position rather than the characteristics of the incumbent" (AFI 38-204, 1994). Therefore, the rationale for making F-22 ABDR ME should be because using contractor personnel would degrade the mission, not because F-22 ABDR questionably fits into one of the vague AFI 38-204 directions.

Civilian Use In Combat Environments

While present legislative, OMB, DoD, and USAF laws and policy seem to convey that combat-related support activities should be manned with military personnel, past use of civilians in combat situations is contradictory. Precedence for incorporating civilians in combat scenarios exists, and studies have shown that civilians have proven very

effective. In addition to the findings of the 1982 Defense Science Board and the comments of Paul Taibl, contractors received numerous accolades for their work in Somalia, including one from the Chairman of the Joint Chiefs of Staff (Nichols, 1995). Despite the praises given contractor personnel, USAF planners still hesitate at including these civilians in war plans.

Throughout our country's history, one civilian has been used for every six or seven military personnel serving in a combat zone (Epley, 1990). In the Persian Gulf, the ratio dropped to 1:50, then increased to 1:10 for the Bosnia peace-keeping mission (Peters, 1996). During ODS/DS, a total of 14,391 contractor personnel and DoD civilians deployed for the Persian Gulf, including 367 who supported the Air Force (GAO 95-5, 1994). The Army used contractors almost entirely for maintenance, technical assistance, equipment deprocessing, and equipment fielding (Dibble, et al, 1993). The performance of these contractors was hailed in an April 1992 report, in which the DoD reported that civilian expertise was invaluable and contributed directly to the success achieved (GAO 95-5, 1994). In addition, the Logistics Management Institute found that, on the whole, the effectiveness of U.S. contractors was highly regarded by all Army personnel they interviewed (Dibble, et al, 1993). Not only has civilian use been widespread and consistent, but each DoD component has participated in the practice. The following examples illustrate this point.

The Army LOGCAP

Until 1985, the use of civilians in hostile environments had always followed an ad hoc arrangement (and in many cases, still does) in response to conflicts (Clow, 1993). At that point, the Army initiated a program to formally plan for the deployment and employment of civilian contractors in combat-related roles (Clow, 1993). This program was termed LOGCAP.

The LOGCAP objective is "to pre-plan for the use of civilian contractors to perform selected services in wartime to augment Army Forces" (AR 700-137, 1985). This pre-planning includes the contractor's ability to deploy an advanced team within 72 hours of the government's notification to proceed (Eby, 1997). While formal use of LOGCAP was not prevalent during ODS/DS, LOGCAP did in fact have a substantial impact in Somalia. Even though Somalia was not a formal combat environment, it was a very precarious environment, and it enabled DoD to test the contractor's advanced team responsiveness. The result: Despite the fact that Somalia wasn't one of the 13 countries included in the original LOGCAP contract, the contractors were still able to create a country plan and respond to the President's announcement to deploy to Somalia by arriving within 24 hours of the Marines hitting the ground (Clow, 1993). Of course, this is what the LOGCAP program was established for, and Somalia validated it. Formally, LOGCAP provides the Army (and the other services, upon their request):

- A rapid and responsive contract capability which augments US forces by meeting CS/CSS requirements,
- the capability for the swift acquisition of contracted logistics support required in crisis,

- flexibility to the Commander in Chief (CINC) to use any mix of forces desired to best accomplish the mission, and

- the augmentation of CS/CSS troops in war and across the full spectrum of military operations. (FM 63-11, 1996)

Overall, the LOGCAP contractors must be considered dependable, responsive, and capable performers. The reason can be found by evaluating the LOGCAP contractor's award fee history. An award fee "is an incentive in contracts that are not susceptible to factors such as precise measurement of cost efficiency and technical performance" (Arnavas and Ruberry, 1994). "The fee established consists of two parts: (1) a fixed amount that does not vary with performance, and (2) an award amount in addition to the fixed amount sufficient to provide motivation for excellence in contract performance . . . " (Arnavas and Ruberry, 1994). To determine the LOGCAP award fee, the Army ranks a contractor on three primary categories: (1) LOGCAP Funds Management Cost Control, (2) Performance, and (3) Coordination and Flexibility (Award Fee, undated). The Army's "Award Fee Determining Plan (AFDP) For Logistics Civil Augmentation Program" explains to contractors that they must earn a composite rating of at least 71 out of 100 in order to receive an award ("AFDP", undated). Any ranking above 70 is labeled above average performance by the contractor.

How has the LOGCAP contractor responded? The contractor has earned rankings of 81 or better on every one of 66 evaluations ("Award Fee History", 1997). These evaluations were for support services for operations from 1992 through 1997, including: Somalia, Haiti, Rwanda, Operation Vigilant Warrior in Saudi Arabia, Operation Deny

Flight at Aviano, Italy, and Operation Joint Endeavor/Guard in Bosnia, Croatia, and Hungary ("Award Fee History", 1997). Table 1 shows the corresponding award fee *(% of Available Fee Awarded)* given for a range of performance (*Total Weighted Ranking*) rankings, and summarizes the LOGCAP contractor's performance for the Army. The *# of Evaluations at Fee* represents the total evaluations which resulted in an award fee in the range given in the table. The *% Evaluations at Fee* is just the percentage of evaluations that fell in the range given in the table.

Table 1. Award Fee Rankings and Contractor History

Total Weighted Ranking	% of Avail. Fee Awarded	# of Eval. at Fee	% Eval. at Fee
0 - 70	None	0	0
71 - 80	8 - 80	0	0
81 - 90	81 - 90	15	0.23
91 - 95	91 - 95	13	0.20
96 - 100	96 - 100	38	0.58
Totals		**66**	**1**

What this table demonstrates is that the contractor has earned an award fee on 100 percent of the opportunities. This is significant. The LOGCAP contractor consistently performed above average, earning above a 90 ranking for 78 percent of the evaluations According to the AFDP, when evaluators assess a ranking above 70, they are saying that the contractor:

[Concerning Ranking Category 1]

- identifies and resolves funding/cost problems independently, within available resources and before any program impact occurs,
- has excellent knowledge of status of all service tasks vis-à-vis programmed costs. Detailed knowledge of all costs at all times,

- continually make efforts to reduce charges with a high degree of success,
- experiences no program problems due to unanticipated cost performance,

[Concerning Ranking Category 2]

- meets or exceeds all contract goals
- provides excellent and thorough work and forethought
- always meets and exceeds standards within resources
- provides exceptional work of the highest caliber, exceeding requirements,
- displays great attention to detail, and

[Concerning Ranking Category 3]

- quickly responds to all requests. ("AFDP", undated)

While the Army's award fee is based on subjective judgment of Army officials and contractor reports, the results of the award fees give strong evidence that contractors are responsive, dependable, and cost conscious. By consistently awarding such high award fees, the Army is telling the LOGCAP contractor that they have performed very well. This record probably prompted one Army official's reaffirmed commitment to contractors as a result of their importance to operations in Bosnia. Colonel Anthony Nida, commander of Transatlantic Programs Center, stated that "LOGCAP has shown that the private sector is now a vital member of the military effort" (McAllister, 1997).

The LOGCAP contractor's performance provides the reasoning that an ABDR contractor could meet the demands of contingency operations and up to USAF standards.

Navy Combat Logistics Force Fleets (CLFF)

The Navy has also used civilians in combat roles, specifically, for conducting the CLFF mission, whereby merchant mariners performed tasks such as underway replenishment for the Navy's combatant fleet (Mauser, 1993). Underway replenishment is one of the most dangerous operations the CLFF performs (Mauser, 1993). For example, 350 US Navy ships were sunk during World War II by the German Navy, resulting in 3000 merchant mariners losing their lives (Mauser, 1993). By outsourcing their Combat Logistics Force Fleet (CLFF), the US Navy saved money because the civilian-manned ships could maintain a higher ops tempo (285 days versus 198 days). As a result, fewer ships and personnel were needed than if organic Navy ships were used (Mauser, 1993). One of these civilian-manned ships was heavily tested during Operation Desert Shield, when the "USNS Henry J. Higgins set a record for the longest deployment among all of the U.S. Navy ships participating in ODS/DS" (Mauser, 1993).

These examples provide good insight into why the USAF can justify using contractors for F-22 ABDR. The idea becomes even more clear when taken in context with the next example of the USAF's very own Rapid Area Maintenance (RAM) Teams.

USAF RAM Teams

While the Air Force presently uses CLSS teams made up of military personnel, this has not always been the case. In fact, RAM teams, made up of mostly noncombatant

civilians, repaired more than 1,000 aircraft during the course of the Vietnam war (Diamond & Luther, 1990). These RAM teams included many very dedicated and loyal civilians, as footnote 58 from a Sacramento Air Logistics Center (SM-ALC) history report attests:

> On 20 May 1969, Major General William W. Veal (SMAMA Commander) presented seven RAM team members the Air Force Civilian Award for valor. [The RAM team members] "knowingly and unflinchingly endangered their lives to repair battle-damaged aircraft in a Viet Cong infested area during one of the heaviest periods of enemy hostilities ever experienced in the Vietnam War." The RAM team completed repairs on AC-47 aircraft considered "vital to the support of the 7th Air Force and the successful defense of the Binh Thuy Air Base" where the repairs took place. (Diamond & Luther, 1990)

These examples have shown that civilians have been used consistently throughout our history and widely throughout our services. Equally important, however, is that *present* DoD plans include the future use of civilians in combat-related roles.

DoD Component Plans Include Future Use

Since U.S. forces will be expected to operate in areas which have very little infrastructure, even more support forces are expected for future contingencies; DoD officials expect some of these to be civilian employees and contractor personnel (GAO 95-5, 1994). The Army is responding very aggressively to this prospect. In addition to LOGCAP, the Army is *planning* that "non-uniformed and/or non-traditional support personnel, from DoD organizations, non-DoD governmental agencies, and the civilian sector, will *deploy* in support of future operations" (TRADOC Pam. 525-200-6, 1994). Furthermore, "DoD civilians and civilian-sector contract technicians will be present

throughout the area of operations (TRADOC Pam. 525-200-6, 1994). Diane Disney, Deputy Assistant Secretary of Defense for civilian personnel policy, states that "more and more civilians are assuming roles during deployments" (Peters, 1996). Increased civilian reliance is typically attributed to deep cuts in uniformed personnel, a push to privatize functions that can be done outside the military, a growing reliance on high-tech weapons, and troop ceilings (Peters, 1996). Lawrence Korb, assistant secretary of Defense for manpower during the Reagan years, suggests that using civilians can be more "politically expedient, as everybody seems obsessed with the number of troops deployed" (Peters, 1996).

While the Army is aggressively planning to use civilians in combat-related roles, many DoD civilians and contractor personnel are actively preparing for these contingencies. One civilian supervisor from the Sierra Army Depot in California recently made the following comment after a one-week, strenuous training session at the Army's Combat Maneuver Training Center in Hohenfels, Germany: "You're [the civilians] out there just like the troops—poking in the ground looking for mines, reacting to hostile situations with the platoon leader. We'd hit the deck and crawl in the mud with (the soldiers)" (Peters, 1996). Preparing for their deployment to Bosnia, the civilians were trained "to use small arms . . . to spot and avoid land mines, and to use the military gear and clothing they were issued" (Peters, 1996). "Brown & Root, Inc., the Defense contractor with the greatest number of personnel deployed for the Bosnia mission, provided similar training—minus the cold weather—in Houston for its employees" (Peters, 1996). Although civilians will not be used in direct combat, their roles in CS and

CSS positions will still expose them to possible life-threatening scenarios. To realize this threat, one only has to remember that "the single deadliest incident during the Persian Gulf war occurred when an Iraqi scud missile hit a barracks housing Army Reservists providing water purification support far from the front" (Peters, 1996). In the fog of war, anything can happen.

Why Outsourcing F-22 ABDR is Justifiable

Considering current policy on outsourcing CS and CSS positions, the interpretation DoD has exhibited through previous operational uses of civilians in combat environments, and future plans for civilian use throughout the theater, outsourcing F-22 ABDR is feasible. However, this issue remains quite complex, and requires further discussion of the investigative questions: (1) Does the law preclude using contractor civilians for F-22 ABDR? (2) Is ABDR considered an *intrinsically governmental function*, thus, off limits to outsourcing? (3) Do DoD or USAF manning criteria preclude using contractor civilians for F-22 ABDR? (4) When the United States Air Force is directed into combat, would CLS civilians remain on duty during hostilities, and would their performance be up to Air Force standards? (5) What are DoD's future priorities, and how do they apply to the ABDR ownership decision?

The Law and Use of Civilians for F-22 ABDR.

Question 1: Does the law preclude using contractor civilians for F-22 ABDR?

Whether or not using contractors during war and other contingencies is legal appears to have been answered by the multitude of times that contractors have been

deployed to a hostile zone. In fact, 36 contractor personnel were sent into Kuwait and Iraq during the ground war; an act which undoubtedly put those individuals in harms way. And the DoD departments are continuing to program contractor use during contingencies.

The US Code does not specifically preclude many functions from being outsourced. Instead, the SECDEF is expected to determine those core logistics functions required for DoD to maintain minimal logistics capabilities in order to achieve timely and effective response to mobilization, national defense contingencies, and other emergencies. However, even if ABDR was declared a core logistics function, the SECDEF have waiver authority to outsource any function deemed by DoD to no longer require performance by government personnel (10 USC Sect 2464, 1997). Even though the SECDEF must receive congressional approval for the waiver, the statute seems to trust the DoD senior official's opinion when making these crucial force structure decisions.

So, what determination should be made for F-22 ABDR—should we use CLSS teams, or can we consider outsourcing? A determination of whether ABDR is core has not been made by the DoD; therefore, this question is debatable. What is known is that the US Code's requirement for *effective and timely response* does not answer this question. The CLSS FAM from a few years ago explained in a position paper on the future of ABDR that operational commands had insisted on retaining organic ABDR capability during the Cold War years. Apparently, when our national strategy was aimed at fighting an all-out, global war, war fighting commands insisted "[they] could not await

the arrival of the CLSS ABDR teams, which might never arrive; therefore, in-house ABDR capability is essential (Fish, 1994)." Another earlier source supports the MAJCOM fears of relying solely on CLSS teams for ABDR. The author of this source found several commands who questioned the responsiveness of CLSS teams in wartime, including, USAFE [United States Air Forces Europe] and PACAF [Pacific Air Forces], who were "unsure of the ability of the CLSS teams to deploy after hostilities began because lack of transport availability and enemy interdiction could inhibit CLSS deployment (Mosely, 1988)."

The lack of transport fear was realized during Operation Desert Shield. Five Sacramento Air Logistics Center CLSS teams effectively deployed to their aerial ports of embarkation, only to be returned to SM-ALC three weeks later after discovering there was no transport available (Luther, 1991). While this did occur early in the build-up operation, and CLSS teams did finally deploy to the Gulf in time for Desert Storm, it is apparent that even CLSS teams encountered problems when they tried to provide *effective and timely* support to the operational units.

ABDR and Intrinsically Governmental Functions

Question 2: Is ABDR considered an intrinsically governmental function, thus, off limits to outsourcing?

The category of the definition which ABDR might fit under, *the act of governing*, contains two questionable aspects. One, the notion that any function which requires personnel to deploy in a combat, CS, or CSS role cannot be outsourced is directly in

conflict with past and present programming. Second, the definition implies that functions which already employ other-than military personnel would be open to outsourcing, whether deployment was a requirement or not. Whether or not ABDR has contractors employed already—regardless, for deployment or otherwise—should not make a difference. Despite the ambiguity of the definition, the persistence with which DoD deploys contractors in contingency operations provides testimony for allowing ABDR to be outsourced.

Clearly, the OMB's criteria is deficient. "As demonstrated in the Persian Gulf War . . . deployability was not a basis for excluding civilians [from some support positions], although problems occurred because of inadequate attention to civilian deployment planning" (GAO 95-5, 1994). The deployability of the contractors who arrived in Somalia was no more suspect than that of the CLSS teams deploying to Desert Shield. Furthermore, as defense contractors incur more contingency responsibilities, they can be expected to improve contingency training for their employees, and become even more efficient in responding to DoD needs. One Army major stationed in Bosnia reported that some of the contractor personnel in Bosnia had deployed more often for military operations than some of the troops (Peters, 1996).

DoD and USAF Requirements and Civilian Use for F-22 ABDR.

Question 3: Do DoD or USAF manning criteria preclude using civilians for F-22 ABDR?

It is evident that the US Code and OMB criteria do not necessitate military incumbency for the F-22 ABDR role. So, how do the DoD and USAF criteria apply to the F-22 ABDR scenario? This question will be answered by evaluating the following individual DoD criterion first (as provided earlier):

> *Law.* This criterion has been discussed previously, and does not directly preclude civilian use for F-22 ABDR. Instead, the DoD is given much authority in deciding this issue.
>
> *Combat Readiness, [military] Training, & Military Background.* What does combat readiness translate to? Being deployable? Able to perform in hostile conditions? Able to perform ABDR tasks? It has already been established that civilian RAM teams performed ABDR admirably during Vietnam, even during some of the most hostile situations, and LOGCAP contractors consistently receive top ratings from the Army for their performance in contingency operations. The GAO interprets the DoD criteria as precluding civilian use if the position requires knowledge or skills unique to the military, where *training* is required training only available in the military (GAO 97-15, 1996). Based on previous DoD precedent of using civilians, the training, military background, and combat readiness requirements are not valid justification for precluding the outsourcing of ABDR. In addition, despite numerous occasions in which civilians were in combat environments, the literature offers no case in which civilians failed to complete the mission.
>
> *Security.* The DoD's security criterion "refers to the likelihood that the incumbents will be involved in combat . . . and will need to use deadly force (GAO 97-15, 1996)." Precedence exists in the former case, and the latter is not too clear. Does the use of deadly force mean in self-defense, or for offensive reasons? DODI 1404.10 allows for civilian employees to carry a weapon for personal defense, with the permission of the component commander, theater commander, or other authorized official (DODI 1404.10, 1992). Regardless of the intent of this criterion, use of deadly force by ABDR technicians in past hostilities has not been reported in the literature. As such, this criterion should not justify carrying equal weight in the ownership decision.
>
> *Discipline.* A GAO study evaluated the discipline criterion by asking whether or not the law required positions be staffed with active personnel due to the fact that incumbents must be able to exercise Uniform Code of Military Justice (UCMJ) authority in certain positions (GAO 97-15, 1996). Since contractors would not be

> expected to be in charge of military personnel—only their own—this criteria should not preclude civilian performance of ABDR.
>
> *Rotation.* The Army does not consider rotation requirements a barrier to outsourcing, and the Navy and USAF are presently evaluating ways to work around this issue. (GAO 97-86, 1997)
>
> *Unusual Duty Hours.* In a recent study on outsourcing officer positions, the GAO discounted the "unusual duty hours" criterion because civilians often work unusual duty hours (GAO 97-15, 1996). Furthermore, RAM civilian team members typically worked twelve hours a day, six to seven days a week (Diamond & Luther, 1990), and Anniston Army Depot employees worked seven days a week, sixteen hours a day for 60 days. (Darby, 1993)

If the DoD's precedence of using civilians in the past is combined with the DoD's intent to use civilians in future combat-related roles, it becomes apparent that neither the US Code, OMB, nor DoD criteria *justifiably* preclude using civilians to perform the F-22 ABDR function. What about the USAF?

If F-22 ABDR is considered a direct CS function, then, certainly USAF manning regulations require a CLSS be used. Although, the Army has taken a different approach to manning this type of support, "[they have] used a contractor instead of force structure to meet some of its combat support and combat service support needs . . . " (GAO 97-63, 1997). As a result, functions the USAF deems not appropriate for civilians, the Army believes otherwise. Here is how the Army describes CS and CSS roles:

> combat support units operate directly with combat maneuver units in wartime, for example, field artillery, combat engineer, and signal units. Combat service support units provide services to combat and other units, for example, transportation and maintenance services. (GAO 97-63, 1997)

Based on the Army's criteria, the F-22 ABDR function, as well as aircraft maintenance, would be considered a CSS function, or indirect CS in USAF terminology.

If the F-22 ABDR function is considered an indirect CS function, there is no definitive answer to the manning question because USAF manning regulations are contradictory and vague. Because of the ME determination is dependent on the type of CS function F-22 ABDR is considered, a clear determination of that must first be accomplished. This determination cannot be made based on other MDSs, as AFI 38-204 warns; instead, actual requirements for the F-22 ABDR position must be taken into account. The complexity of the F-22 will likely warrant different requirements than the other MDSs; therefore, whether F-22 ABDR is ME will have to wait for final F-22 ABDR requirements determinations.

Civilian Reliability and Performance

Question 4: *When the United States Air Force is directed into combat, would CLS civilians remain on duty during hostilities, and would their performance be up to Air Force standards?*

While predicting the future and whether contractor personnel will remain during hostilities is impossible, the LOGCAP contractors past performance and other precedence, present plans, and the comments of reputable sources show that contractors will perform effectively, if not, excellently, even in hostile conditions. As for guarantees, there are none. However, the contractor is warned by DoD that "contractors providing services designated as essential by a DoD component are expected to use all means at their disposal to continue to provide such services, in accordance with the terms and conditions of the contract . . . " (DODI 3020.37, 1990). The ABDR contractor would be

performing E-E contractor services; therefore, any failure of a contractor to deliver or perform as agreed in the contract could be considered reason for the government to terminate for default. The following excerpt highlights the grave consequences of this type of termination:

> Termination for default is undoubtedly the most traumatic experience that can befall a Government contractor. Not only does termination (unless specifically contested by the contractor) put an end to performance of the contract and, in all probability, to the contractor's hopes for profit on the contract, it also subjects the contractor to possible liability for the Government's extra costs of having the contract completed by another contractor. In addition, the termination is a negative entry on the contractor's record that could prevent the contractor from receiving future contract awards. (Arnavas and Ruberry, 1994)

The implications of this type of termination provide a strong motivation for a contractor to perform as expected. Whether the contractor has a requirement to perform only ABDR or to help launch aircraft, the contractor will be motivated to perform according to the contract agreement. To minimize confusion over what requirements are expected of a contractor, DoD planning activities must ensure they identify services designated as mission essential in the contract statement of work (SOW)" (DODI 3020.37, 1990). The SOW is the document which explains *exactly* what the contractor must perform in order to be responsive to the respective commander. Therefore, if the SOW only specifies ABDR requirements and there are none, the contractor is under no obligation to perform any services until ABDR is required. If ABDR planners wish to use contractor personnel for other-than-ABDR tasks, such as assistance in aircraft launch and recovery operations, they need to ensure their requirements are placed in the SOW.

Contractors can provide a similar level of responsiveness as military assets (both personnel and materiel) only "through the most careful drafting of contract requirements (the SOW), choice of contract type, and contract administration" (AR 700-137, 1985). The LOGCAP EVENT contract is a cost-plus-award-fee contract, as explained before. Consequently, Army LOGCAP administrators must ensure contractors are accurately evaluated on a quarterly basis to determine the award fee portion of the contract. In addition, the GAO recently recommended that the Army develop improved financial reporting and internal controls mechanisms that provide commanders with the assurance that LOGCAP services are necessary and reasonably priced" (GAO 97-63, 1997). As long as needs determinations are thorough and explicitly stated in the SOW and the contract is carefully administered, there is reason to believe that F-22 ABDR contractors will perform admirably when deployed. Supporting this reasoning, Major General Jim Childress, Commander of San Antonio ALC (SA-ALC), believes that as long as contractors have an understanding of their responsibilities, they are reliable and can be expected to deploy and perform well during contingencies (Childress, 1997).

DoD and USAF Future Priorities

Question 5: What are DoD's future priorities, and how do they apply to the ABDR ownership decision?

In March of 1996, the DoD submitted *Improving the Combat Edge Through Outsourcing* to Congress, a report outlining the three major challenges facing the DoD in the post-Cold War era. The DoD stated that these three challenges were *readiness*,

quality of life [for our military members], and *modernization* (DoD Report, 1996). The report explained how the DoD has begun a series of initiatives aimed at increasing the efficiency of operations to gain more value from every dollar (DoD Report, 1996). One initiative is the DoD's intention to evaluate all support operations to determine where competitive forces can improve overall performance at lower costs (DoD Report, 1996). Through these initiatives, the DoD hopes to improve readiness, generate savings for modernization and improve the quality and efficiency of support to the warfighters (DoD Report, 1996). This following quote provides keen insight into the impact of DoD's future priorities:

> Previously senior leadership officials have resisted farming out this type of work [support like the LOGCAP provides] because they feared contractors would be unreliable in wartime. Most of this opposition has fallen by the way side as the LOGCAP contract has been successful in cutting military expenditures for logistics and freeing up dollars for modernization. (AFLMA, 1996)

In other words, the DoD is searching for "best value" alternatives; consequently, if contractors can provide "best-value" ABDR, they should be considered a viable alternative.

In May 1995, the USAF hinted at what future priorities they have concerning ABDR. HQ/USAF issued a message which removed the requirement operational-level units had for maintaining an ABDR capability (USAF Message, 1995). This policy change was primarily due to the additional costs of having an operational-level capability. Now, the CLSSs have sole ABDR responsibility. However, considering past PACAF and USAFE concerns, and the problems that CLSS teams had in deploying to ODS/DS in

a US Code-prescribed *effective and timely* manner, this new policy seems to convey that ABDR is less of a priority to USAF leaders, as compared to other resource-dependent priorities like modernization and quality of life issues. If this is so, outsourcing would seem to be a viable alternative for the ABDR function.

Assessment of the investigative questions leads to the determination that using CLS for the ABDR function is justified. Now, potential benefits and short-comings incurred from using contractors need to be evaluated.

Implications From Using Contractors For F-22 ABDR

As important as understanding the laws, policies, and criteria governing outsourcing, it is equally vital to address specific implications which might exist if contractors are selected for ownership of the F-22 ABDR function. These implications will include a number of potential benefits and shortcomings which will become inherent in the USAF's F-22 combat sortie generation capabilities. While this study will focus on economic trade-offs between the alternatives, other issues must also be investigated. The ABDR decision-maker will want to consider the potential benefits and shortcomings, as well as the final economic analysis in making an ABDR ownership decision.

Benefits

So, what benefits could we reap from using contractors vis-à-vis military members? Major William Epley reported that two of the Army's reasons for using contractors were due to the nature of limited wars and increasing technical complexity of equipment (Epley, 1990). The increased complexity of equipment [i.e. weapon systems]

has been one main reason why the maintenance function has been one of the logistics functions which has increasingly relied upon civilians in the combat zone (Epley, 1990). Limited wars mean that troop limits exist, and accomplishing a mission may depend on the use of civilians. For example, the G4 of the Japan Logistics Command estimated that if all supply and service functions in the Korean War had been conducted with soldiers, an additional 250,000 troops would have been necessary—a number which exceeded the Army's force structure allowance (Epley, 1990). By using contractor civilians, the theater commander has more flexibility when determining theater force composition. Another conceivable benefit would be a smaller USAF mobility footprint. Since contractor personnel are responsible for finding their own way to the theater (Gruber, 1997), there would be less demand on the USAF's finite transport resources.

Of course, these benefits are not the only foreseeable ones. Considering the ABDR function is not employed very often, outsourcing could provide USAF lucrative returns by using a "standby" ABDR team approach. This approach would be similar to using military reserves; hence, USAF could expect savings from personnel reductions and other efficiencies. The GAO reports that personnel reduction is the main reason for obtaining savings through outsourcing (GAO 97-86, 1997). The economic possibilities which may exist will be investigated in Chapter 4.

Potential Shortcomings

As with any alternative, there are shortcomings to consider. Potential shortcomings which might exist with using CLS include: (1) lack of responsiveness from

the contractor (2) possible non-performance of the contract (due to strikes, hazardous conditions, or other problems), (3) arbitrary increases in contractor prices and higher prices due to lack of competition, and (4) civilian casualties. One example of the risks of using non-military involved civil service merchant mariners on a Naval Fleet Auxiliary Force ship during Desert Storm. Captain David Teel, commander of a sealift vessel, remembers a port call in Houston, Texas where, while waiting for the ship to be loaded for its second trip to the Gulf, nearly half of [his] crew decided to get off the ship, leaving him scrambling for crewmen" (Mausar, 1993). He commented that "while seamen as a whole are pretty patriotic in a crisis, I suspect if shooting breaks out a certain percentage will take a hike" (Mausar, 1993). To alleviate the risks of depending on mariners to stay in a war zone during Desert Storm, the Navy "authorized retroactive bonus pay to Military Sealift Command mariners" (Mausar, 1993). The bonus pay was for "fairly compensating the civil service mariner for risking life and limb in the war zone and encouraging them to do so in any future conflicts" (Mausar, 1993).

Of course, if the ABDR contractor experienced a loss of personnel, they would be responsible for ensuring replacements were provided, and they would be motivated to do so to avoid a termination for default. The current LOGCAP contractor provides this assurance by maintaining a large database of individuals who have the required technical and physical abilities (Eby, 1997). Once the contract requirements are known (from the SOW), the contractor begins assembling a database of personnel who are qualified to do the mission, both physically and technically, and can be ready to deploy at a moments notice (Eby, 1997).

In regards to escalating contract prices, the best precaution is sound preplanning. A concisely written SOW, combined with sound contract administration and the enforcement rules of the Truth in Negotiations Act (TINA) will provide good security against arbitrary contract price escalations. TINA provides a sound vehicle for ensuring the DoD receives a fair estimate for contractor work. One source states that TINA rules have

> had a tremendous impact on the Government contractor: the slightest defect or omission in cost or pricing data submitted to the Government—even if unintentional—may lead to a reduction in the contract price or even to a fraud investigation of the contractor. (Arnavas and Ruberry, 1994)

The next issue concerns competition, and whether adequate competition will exist to ensure the USAF receives the best value for limited budget resources. How much competition will exist, and will the USAF be able to take advantage of that competition? These are questions which not only affect the ABDR function, but, the logistics support of all weapon systems. With the reduction in prime military contractors, USAF contractor personnel and logistics managers will have to be more aware of contractors' product and services prices to ensure the DoD receives a fair value for scarce budget resources.

And while civilian casualties are not a desirable occurrence, it is clear that civilians will serve throughout the theater of operations. Since no location is totally secure during the demands and uncertainties of war—the Iraqi scud attack is a perfect example—civilian, as well as military casualties will likely occur. Surprisingly, though, no LOGCAP contractor has lost a life due to hostilities, despite one occasion where a

contractor employee stepped on a anti-tank mine which never went off (Gruber, 1997). Another close call occurred when the front end of a jeep carrying contractors was blown off by a mine (Gruber, 1997).

How would contractor casualties affect the F-22 ABDR function? The answer to this question may lie in a discussion of the LOGCAP contract. This contract requires that contractors provide insurance to their personnel, and since the LOGCAP contract is a *cost-plus* type contract, the insurance premiums would be allocable costs to the government (Gruber, 1997). These costs would not be inconsequential, either. Currently, insurance rates are quite high, ranging from $3.00 to $17.00 for every $100 of labor (Gruber, 1997). However, since Brown & Root Services Corp. (the LOGCAP contractor from 1992 through completion of the Bosnia EVENT) has extensive experience, CIGNA has given them the lowest insurance rate of $3.00 (Gruber, 1997). Of course, "if the grieving family or injured employee were to take the contractor to court and the contractor prevailed, the government would have to reimburse the legal fees also" (Gruber, 1997).

What this implies for the ABDR function is that the CLS alternative would probably result in higher personnel costs during wartime because of the potentially high insurance premiums the government would have to pay. In any event, none of us can predict what will happen in war, we can only make plans for what may occur. The Army has already accomplished much in reducing many anxieties through their efforts with LOGCAP, and they continue to aggressively pre-plan for the use of civilian contractors in hostile zones.

Summary

This chapter reviewed US law and various government regulations regarding using contractor personnel in contingencies. In addition, past DoD use and present plans to continue this use were explained. Finally, the five investigative questions of set one were addressed, and it appears that using contractors for ABDR is justifiable. By using CLS, the USAF could reap many benefits; however, there are also some shortcomings which would exist, and the appropriate ABDR decision-maker must keep these in mind. The LOGCAP has done much to alleviate concerns with outsourcing uncertainties, and with the historical precedence which exists, provides good evidence for including outsourcing as a viable alternative to organic ABDR. In light of that alternative, Chapter 3 will discuss economic analysis and how it applies to the F-22 ABDR scenario.

3. Economic Analysis and F-22 ABDR

Introduction

"Economic analysis is a *systematic approach* to the problem of *choosing the best method* of allocating *scarce resources* to *achieve a given objective*" (DODI 7041.3, 1995). So, how does this definition apply to the F-22 ABDR ownership decision? It is common knowledge that DoD resources are scarce, and becoming more and more so as executive and legislative decision-makers attempt to balance our national budget. In addition, there is a primary given objective of ABDR:

> to provide organizational, intermediate, and depot level maintenance and modifications, crash recovery, crash damage repair, and aircraft battle damage assessment and repair (ABDAR) on aircraft and aircraft systems to improve aircraft fleet readiness. (AFMCI 10-202, 1997)

Finally, more than one method clearly exists for providing ABDR, as the previous chapter showed. Consequently, the conditions for using economic analysis are apparent for the F-22 ABDR ownership decision, and a systematic approach, rather than military incumbency, must be taken. In this study, only two alternatives will be evaluated. However, this does not mean that other alternatives do not exist.

This chapter will provide an overview of economic analysis, as it pertains to the F-22 ABDR ownership decision; subsequently, the methodology for costing the base case—using CLSS teams for F-22 ABDR—will be presented. Because key contractor data was unavailable, only a discussion of likely CLS costs will be included. In conducting this economic analysis, a cost estimating model will be chosen as a guide

which will provide structure to this study and help with all calculations. Subsequently, pertinent cost categories and elements will be described, along with the data used for costing these categories. Before any methodology is chosen, however, various assumptions must be made. These assumptions are crucial for building feasible estimations of the cost of using CLSS teams for ABDR. Included in the assumptions will be a description of all negligible, wash, and sunk costs. The purpose of this chapter is to prepare the reader for the detailed cost analysis which appears in Chapter four. As a reminder, the study's purpose is provided once more.

Purpose Restated

The purpose of this study is to evaluate crucial ABDR ownership questions in order to determine whether CLS is a viable alternative to CLSSs for providing the F-22 ABDR function and provide a recommendation for which alternative is best for the USAF. In this chapter, the economic analysis questions in Investigative Question Set 2 will be addressed.

Economic Analysis Definitions

Cost Driver

> Any factor that affects cost. That is, a change in the cost driver will cause a change in the total cost of a related cost object. (Horngren, et al., 1994)

Cost Object

> Anything for which a separate measurement of costs is desired. (Horngren, et al., 1994)

Fixed Cost

Cost that does not change in total despite changes in a cost driver. (Horngren, et al., 1994)

Incremental Cost

The difference in total cost between two alternatives. Also called differential cost and net relevant cost. (Horngren, et al, 1994)

Negligible Cost

A negligible cost is a cost which is so small as to carry negligible weight in an economic decision.

Opportunity Cost

The contribution to income that is forgone (rejected) by not using a limited resource in its best alternative use. (Horngren, et al., 1994)

Sub-Optimal Decision Making

Arises when a decision's benefit to one sub-unit is more than offset by the costs or loss of benefits to the organization as a whole. Sub-optimal decision making may occur (a) when there is lack of harmony or congruence among the overall organization goals, the sub-unit goals, and the individual goals of decision-makers, or (b) when no guidance is given to sub-unit managers concerning the effects of their decisions on other parts of the organization. (Horngren, et al., 1994)

Sunk Costs

Costs that have already been incurred as a result of past decisions. They are sometimes referred to as historical costs, and the money spent is gone for good. (Gwartney and Stroup, 1995)

Variable Cost

Cost that changes in total in proportion to changes of a cost driver. (Horngren, et al., 1994)

Wash Cost

A cost which is equivalent for all alternatives, thus can be discounted from the analysis.

Assumptions

Since the real cost of any future system is difficult to obtain, numerous assumptions are established in order to allow an economically feasible analysis to be conducted given the uncertainties that exist (DODI 7041.3, 1995). Included in the assumptions will be costs which are considered as either negligible or wash costs. The assumptions were based on the realization that the F-22 ABDR CONOPS is in the initial stages of development. The F-22 ABDR CONOPS outlines the USAF requirements for the F-22 ABDR capability. An example would be the requirement for F-22 ABDR to provide a full low-observable signature to a damaged aircraft. The key assumptions included:

1. The F-22 depot function will be contractor logistics supported.

2. Any contractor potentially chosen for the ABDR function would also be one which performed under the depot contract. Since non-competitive contracts can be awarded if the "property or service is available from only a single source" (Arnavas and Ruberry, 1994), it is not too unrealistic that the USAF would use a depot contractor to perform the ABDR function. While other contractors may be able to perform ABDR on the F-22, access to proprietary information may, in a sense, result in only a few sources being available.

3. Although, CLSSs are made up of more than just ABDR teams—they also include Rapid Area Distribution Support (RADS) teams, Combat

Transportation Tracking and Packing teams, and Command and Control (C2) teams—only ABDR teams will be included in this economic analysis.

4. The level of training and knowledge required for F-22 CLSS personnel is assumed equivalent to that of F-117 personnel for purposes of analogous estimating.

5. The contractor supplying the CLS ABDR teams will not specifically carry ABDR team personnel on their payroll during peacetime. All CLS ABDR personnel would be carried as depot maintenance technicians or assembly line personnel, or be selected off a database of qualified individuals. The LOGCAP contractor also uses a database of individuals for providing personnel (Eby, 1997). Any technical or mobility training the contractor personnel will need would be included in the peacetime costs of the CLS alternative.

6. Equipment and material costs are either wash or negligible costs. One USAF Materiel Command Instruction, *Combat Logistics Support,* explains that "[ABDR] teams carry a limited amount of specialized tools and material. The ability for teams to accomplish maintenance is limited by the availability of special tools and support equipment" (AFMCI 10-202, 1997). This availability refers to the units being supported by the CLSS. While much of the materials and equipment will be provided by war wagons—pre-positioned trailers stocked with numerous critical ABDR equipment and material items—these war wagons will be considered wash costs. As for any equipment and material items used by the CLSS during peacetime, the 652nd CLSS Custody Authorization/Receipt Products (CA/RP) listings reflected a negligible dollar amount ("Custody", 1996).

7. Non-recurring facility costs are unknown and will be considered negligible or a wash cost in this study. Because the development of the F-22 ABDR concept is in its initial stages, the F-22 Logistics Support Division, co-located with the 652nd CLSS, has not determined the eventual location of the F-22 CLSS. In addition, no determination has been made as to whether the F-22 will have its own CLSS or will be joined with another MDS (Krontz, 1997), much the way the F-117 was joined with the A-10 and F-111. As a result, it is not feasible to determine whether the F-22 ABDR teams will require all facilities to be initial capital investments, or whether some facilities from other MDSs will be shared.

8. Non-recurring and recurring costs for maintaining engineering data and technical manuals will be considered wash costs.

9. The CLS alternative will be more expensive during a deployed status because of incremental personnel costs.

10. The engineer element will be considered a resource of the CLSS; thus, 100 percent of an engineer's composite pay and acquisition and training (A&T) costs were included.

Economic Analysis Overview

As described in DODI 7041.3, *Economic Analysis for Decision Making*, a *systematic approach* must be taken to ensure the wisest use of scarce budget resources. The general principles of economic analysis include the following two requirements for a systematic approach:

- Each feasible alternative for meeting an objective must be considered, and its life-cycle costs and benefits evaluated.

- All costs and benefits are adjusted to "present value" by using discount factors to account for the time value of money. Both the size and the timing of costs and benefits are important. (DODI 7041.3, 1995)

With these requirements in mind, the economic analysis of the two ABDR alternatives will focus on the projected life-cycle of the F-22 weapon system. An F-22 System Program Office (SPO) representative stated that the F-22 lifetime will extend to approximately 2032 (Rega, 1997), or, a total lifetime of 29 years. Some key considerations included in this life-cycle approach are: (1) the approximate percent of the F-22 weapon system life-cycle in which the USAF tasking will require ABDR teams to be deployed to a hostile zone, (2) the scheduled ramp-up and phase-out schedule for the weapon system prime equipment—operational F-22 Raptors, and (3) the corresponding ABDR team requirements.

Wartime vs. Peacetime Cost Considerations

Being prepared for war in order to increase sortie generation as a force multiplier during war is the primary mission of the CLSSs. However, since mission performance and cost generation under wartime conditions can be quite unpredictable, this study will focus on the peacetime role and accompanying costs of the ABDR function. Considering that the majority of our country's years are spent at relative peace, this approach is reasonable. Nevertheless, a "what-if" analysis of wartime costs will be presented in Chapter 4 to illustrate possible scenarios which could affect the life-cycle costs (LCCs) of the F-22 ABDR function.

Operational F-22s and Corresponding Number of ABDR Teams

At this point, some comments concerning the potential number of F-22 ABDR teams are warranted. These numbers are highly dependent on a few parameters, namely, weapons system vulnerability and number of aircraft. While some upgrades will improve the F-22s vulnerability posture in the next 20 or 30 years, advanced threat technologies will also improve; therefore, this study assumes that it is highly unlikely that any vulnerability improvements will have an affect on the total number of ABDR teams. Therefore, the key parameter affecting total ABDR teams is the number of aircraft. Unfortunately, the number of aircraft to be produced changes continually during a weapon system acquisition, as the recent May 1997 Quadrennial Defense Review demonstrated. It is possible that even more reductions could be placed on F-22 acquisition numbers. But, in this analysis, the total F-22 acquisition amount was based

on the number of F-22s to be acquired per the 1997 Quadrennial Defense Review—339 aircraft.

The ramp-up and phase-out schedules for the F-22 acquisition were used to develop discrete CLSS team-size phases. These phases were used to simplify the cost calculations. Instead of a continuously changing team requirement, the team requirement was only adjusted a few times at the beginning of the various phases. This approach and the resulting team numbers in Table 2were validated with the F-22 Logistics Support Division at SM-ALC. Table 2 depicts the number of projected F-22s and ABDR teams throughout the life-cycle.

Table 2. Operational F-22s and ABDR Teams Throughout Life-cycle

YEAR(S)	OPERATIONAL F-22S	ABDR TEAMS
2002 - 2003	0	2
2004	35	2
2005	62	2
2006	96	3
2007	131	3
2008	167	3
2009	203	4
2010	238	4
2011	274	4
2012	309	5
2013	339	5
2013 - 2032	339	5

Cost Estimating Model

Use of a cost estimating model's breakdown structure facilitated calculating the cost differences between the two ABDR alternatives. This approach is typical throughout DoD's cost estimating society, as the work breakdown structure is "the estimator's

primary reference in identifying the program elements to be estimated" (AFSC Handbook, 1987). One estimating model, the Cost-Oriented Resource Estimating (CORE) model, "is designed to provide a cost-estimating model that MAJCOMs may use to develop aircraft squadron annual operations and support (O&S) cost estimates" (AFI 65-503, Atch A54-1, 1994). In addition, this model is used in conjunction with numerous cost and planning factors provided in AFI 65-503, *US Air Force Cost and Planning Factors*. Because of these convenient characteristics, the estimation in this study relied heavily on the CORE structure.

Cost Categories and Elements

Cost categories and elements provide structure to the estimating process, as well as ensure all pertinent costs are included. The categories used in the CORE model are listed in Table 3.

Table 3. CORE Cost Categories

Categories
1. Unit Personnel
2. Unit Level Consumption
3. Intermediate Maintenance
4. Depot Maintenance
5. Contractor Support
6. Sustaining Support
7. Indirect Support

One very important idea to consider is that O&S estimates should not be accomplished with a complex model (AFI 65-503, Atch A54-1, 1994). Use of such a model can be very costly, and could preclude effective and timely support in the decision making process (AFI 65-503, Atch A54-1, 1994). Instead, "the model should be

structured so that it is useful in the early phases of the acquisition program and can evolve to accommodate more information as the program continues through the acquisition phase" (AFI 65-503, Atch A54-1, 1994). Since the F-22 ABDR program is in its infancy, a more basic approach must be used, and that is precisely what this study will do.

The CORE model provides a very good baseline for choosing categories; however, the ABDR analysis is a less broad problem than that for which the CORE model is developed for. As such, only pertinent CORE categories were retained. For example, intermediate and depot maintenance are considered negligible costs since the ABDR teams do not actually operate aircraft, and the equipment they must maintain is a very small portion of the total O&S costs. Instead of a depot maintenance category, a *Depot Field Requirements* category was included. This category represents the costs incurred by depot field teams (DFTs) from a CLSS or contractor for meeting a operational unit's higher-than-organizational maintenance requirements in the field—a depot field repair. Some typical costs within this category are labor, per diem, travel (to the location), transportation (at the location,e.g., rental car), and lodging for DFT personnel.

Sustaining support costs are those incurred for support equipment replacement, modification kits, other recurring investment (e.g., some replenishment spares), sustaining engineering support, software maintenance support, and simulator operations (AFI 65-503, Atch. A54-1, 1994). Although the CLSSs do receive engineering support from depot engineers, the cost for these engineers is being included in the unit personnel

category. All other sustaining support costs were found to be either non-existent or negligible for this ABDR study; thus, the category was not included.

Of the original seven CORE categories, only four were retained. A listing of the final cost categories and elements used for this study is provided in Table 4. In order to assess all F-22 ABDR cost trade-offs, the DFR and *Administration and Planning* categories were included. The DFRs category was added to track the cost differences between having a CLS or CLSS DFT accomplish the USAF F-22 depot field repairs. The Administration and Planning category was created primarily to track additional costs from the CLS alternative. There are other categories, such as unit personnel and unit level consumption, where the CLS will be considered to have no costs because they will have no standing ABDR team. However, the CLS alternative will generate its own peculiar requirements (e.g., contingency planning), thus, the motivation for creating the Administration and Planning category. In addition, any required exercise or ABDR

Table 4. F-22 ABDR Cost Categories and Elements

Category	Key Element(s)
1. Unit Personnel	Composite Pay Acquisition & Skills Training
2. Unit Level Consumption	Operating Budget
3. Contractor Support	Engineering Data Technical Manuals
4. Depot Field Requirements	Labor Per Diem Travel (to location) Transportation (at Location) Housing
5. Indirect Support	Personnel and Installation Support
6. Administration & Planning	Contingency Planning ABDR Training Exercises

training will also be included in this category. Since any CLSS costs that might fit this last category were already included amongst the previous five categories, the CLSS cost for this category will be zero.

Cost Estimating Methodology

The methodology used in this study was a medley of a variety of methods. First, the focus in this cost analysis was to obtain as much detail as warranted in order to delineate between the two ABDR alternatives; therefore, engineering analysis was the overall method used for costing the F-22 CLSS. An engineering approach (also known as a "grass roots" methodology) is very detailed. Fabrycky and Blanchard explain that "estimating by engineering procedures involves an examination of separate segments at a low level of detail" (Fabrycky and Blanchard, 1991). While much of the data required for this study was unavailable, it was possible to segregate the CLSS function into major cost driving categories, as were discussed in the previous section. Other cost estimating techniques applied were: (1) analogy, (2) cataloguing, (3) manloading, and (4) a cost factor. A brief explanation of each method is given.

The analogous method consists of costing the new system by comparing it to a comparable system. In this study, the new system is the F-22 ABDR CLSS, while the old system is the F-117 portion of the 652nd CLSS (which also includes F-111s and A-10s, and will now be referred to as the F-117 CLSS). While the F-22 ABDR approach will not be exactly like that of the F-117, many similarities will exist. Using this approach for

the F-22 CLSS costing problem is valid, and follows a precedent. One example of even less similar systems compared was given by Fabrycky & Blanchard, who explained that certain aircraft companies in the past would use analogies between aircraft and missile studies (Fabrycky & Blanchard, 1991: 146).

The cataloguing and manloading techniques were used in a complementary way for this study. "Cataloguing entails estimating off-the-shelf items using a catalogue or handbook which supplies the cost of the items," and the manloading method of estimating is an estimate made by the ownership or management of the unit to be estimated (AFSC Handbook, 1987). "The manager or estimator projects the number and type of skilled individuals needed to complete a specific work effort" (AFSC Handbook, 1987). In the CLSS problem, actual ABDR team composition was available through the F-22 Logistics Support Division. They supplied the estimate of what Air Force Specialty Codes (AFSCs) and number of each would go into building an F-22 ABDR team. Then, using cost tables (the catalogue) from USAF publications allowed the pricing of F-22 CLSS unit personnel.

"Using a [cost] factor or a ratio allows the estimator to capture a large part of an estimate with limited description of both the historical data base used to develop the factor, as well as the program to be estimated" (AFSC Handbook, 1987). Furthermore, estimators use cost factors for "such areas as training, data, peculiar support equipment, systems engineering, and program management when lack of definition and/or time constraints prohibit detailed grass roots or analogy estimating" (AFSC Handbook, 1987). In order to obtain an estimate for the indirect support costs for the F-22 CLSS, cost packs

available from the USAF Visibility and Management of Operations and Support Costs (VAMOSC) program were needed to formulate a valid cost factor. These cost packs provided indirect support costs for numerous MDSs, and with that information, a cost factor could be developed in order to predict the F-22 CLSS indirect support costs. A cost factor approach was also used to estimate F-22 unit level consumption costs.

F-22 ABDR Team Composition

Considering an F-22 CLSS does not yet exist, to obtain a cost estimate for the F-22 CLSS, the first step involved using the F-117 portion of the 652nd CLSS (from now on, referred to as the F-117 CLSS) as an analogous ABDR support entity. This logic is based on the comparable technologies between the F-117 and F-22; essentially, they both use fiber optics, low observable composite materials, etc. While the F-22 design uses state-of-the-art and other advanced technology elements, the level of training and knowledge required for CLSS personnel is assumed equivalent for purposes of analogous estimating. By doing this, the ABDR team size and AFSC construction could be based on the F-117s—in a sense, an analogous transformation. The F-22 Logistics Support Division supported this approach, and stated that the F-22 ABDR team construction would only face minor changes from that of the F-117, however, the size would likely remain identical (Krontz, 1997). The final word on ABDR team composition resides with the CLSS FAM, or AFMC/LGM. Table 5 illustrates the F-22 ABDR team composition used for this study.

Table 5. F-22 ABDR Team Composition

AFSC	Rank	#/Team
ABDR Team		
2A353B	E5	2
2A373B	E6	1
2A372	E6	1
2A390	E8	1
2A654	E5	2
2A656	E5	1
2A676	E6	1
2A753	E5	4
2A773	E6	1
Engine Team		
2A651A	E5	2
Engineer Element		
062E3A	O3	1

The *AFSC* and *#/Team* are exactly the same as those of the F-117 teams. In order to calculate team costs, though, a rank had to be assigned to each AFSC. Three considerations were used for doing this. First, position four in the AFSC identifies a certain level of skill, like a journeyman or craftsman. These skill-levels are usually obtained when a service member reaches a certain rank. For example, a 2A372 skill level typically belongs to a technical sergeant, while a 2A352 would be a staff sergeant. However, the correlation between AFSC and rank do not always hold true. As a result, the second and third considerations were to obtain the 652nd CLSS Unit Manning Document (UMD) and 654th CLSS deployment roster. These items are living documents by which valid rank determinations can be made. The UMD lists actual ranks beside each respective AFSC. Although these ranks do not represent actual personnel assigned to the position, they should represent the expected rank. To ensure this is true, the 654th

deployment roster was used. After checking each AFSC position and the corresponding rank of the individual assigned to the position, a rank determination could be made. The final rank chosen for each AFSC was that rank which occurred most frequently in the UMD and deployment rosters. The deployment roster and UMD agreed very well, and the resulting rank assignments are listed in Table 5.

Expected # of F-22 ABDR Teams

To facilitate life-cycle cost calculations, an *expected value* approach was applied to the F-22 life-cycle cost categories. The purpose of this method was to remove the requirement for calculating category costs for individual time periods throughout the life-cycle. By using the expected number of ABDR teams, category costs could be obtained by (a) calculating category costs for the entire life-cycle based on the maximum complement of ABDR teams—five, then, (b) multiplying the pre-adjusted category life-cycle costs by the ratio of expected teams to the full complement of teams. Table 2 provided the ramp-up schedule for ABDR teams which will be used for obtaining the expected number of teams. All pertinent calculations and the final expected number of ABDR teams are given in Table 6.

Table 6. Expected Number of ABDR Teams

Teams (A)	Years	% Years (B)	A x B
2	4	0.13	0.26
3	3	0.10	0.29
4	3	0.10	0.39
5	21	0.68	3.39
Column Totals	31	1.00	4.32
Expected # of Teams			**4.32**

Using this value for expected number of teams, the ratio of expected to full complement—or *expected team factor (ETF)*—becomes 4.3226/5, or .8645. This is a rounded figure, and all calculations are based on an ETF which has not been rounded. The ETF will be used for all categories because all the category costs have a direct correlation to the number of ABDR teams.

Data Used For Study

The data used in this study were compiled from numerous sources and are listed in Table 7. Cost factors found in AFI 65-503, *US Air Force Cost and Planning Factors*, were used for unit personnel calculations. The following AFI 65-503 attachments were used: (1) A17 (*Typical Acquisition and Training Costs*), (2) A19-1 (*FY 1997 Military Annual Standard Composite Pay*), (3) A19-3 (*FY 1995 Active Military Turnover Rates*),

Table 7. Cost Categories, Elements, and Data Sources

Category	Elements	Data Sources
1. Unit Personnel	Composite Pay Acquisition & Initial Training	F-117UTC, AFI 65-503, Table A19-1 AFI 65-503, Table A18-1A, A17, USAFA/FM
2. Unit Level Consumption	Daily Operations	652nd CLSS Operating Budget
3. Contractor Support	Engineering Data Technical Manuals	F-22 Logistics Support Division
4. Depot Field Requirements	Labor Per Diem Travel (to location) Transportation (at location) Housing	652nd CLSS Cost Estimate 654th CLSS
5. Indirect Support	Personnel & Installation Support	VAMOSC F-15, F-16, F-117 Cost Reports
6. Administration & Planning	Contingency Planning ABDR Training Exercises	January 1997 Army LOGCAP Firm-Fixed Price Contract

(4) A18-1A (*Variable Cost By Enlisted Air Force Specialty Initial Skill Training*), and (5) A18-1B (*Variable Cost By Officer Air Force Specialty Initial Skill Training*). Cost packs were obtained from the USAF VAMOSC. Other data sources included the 652nd UMD, the 654th deployment roster, the 652nd Custodial Account/Receipt Products (CA/RP), the 652nd Annual Operating Budget, and the most recent firm-fixed price LOGCAP contract.

Data Normalization

All cost estimates are listed in 1997 constant dollars. All cost data were either in 1997 constant dollars, or, appropriate inflation indexes were used to convert them to 1997 constant dollars. Since none of the costs used were obtained from budgeted numbers, no discounting will be required. Final life-cycle costs will be in 1997 constant dollars.

Summary

This chapter provided an overview of economic analysis, as it pertains to the F-22 ABDR ownership decision. It explained key definitions and outlined the assumptions necessary when doing an economic analysis under some uncertainty. The number of F-22 ABDR teams was presented, followed by a development of cost categories and elements using the CORE model as a basis. Subsequently, engineering, analogous, cataloguing, manloading, and cost factor estimating methodologies were described, and the F-22 team composition was set by using an analogous approach. While more than one alternative to the base case is feasible, only the alternative of using CLS for the entire ABDR function will be evaluated.

"Economic analysis is a *systematic approach* to the problem of *choosing the best method* of allocating *scarce resources* to *achieve a given objective*" (DODI 7041.3, 1995). How this definition applies to the F-22 ownership decision is that the conditions for using economic analysis are apparent and a systematic approach, rather than military incumbency, must be taken. The purpose of this chapter was to prepare the reader for the detailed cost analysis which appears in Chapter 4.

4. Analysis and Results

Introduction

This chapter will provide detailed analysis of CLSS category costs, followed by a final estimate of the base case. Unfortunately, the information required for a definitive total cost estimate for the CLS alternative was unavailable; as a result, only CLSS costs will be determined. However, CLS costs for each category will be discussed in regard to likely scenarios, and this will provide useful information to the ABDR decision-maker. The value of this information is that the ABDR decision-maker will have a virtual ceiling for how high a contractor proposal can be in order to be the most cost-effective alternative. When performing the calculations and making any conclusions, it was especially important to remember that the contractor would not employ an ABDR force during peacetime (assumption 5 in the previous chapter).

The presentation of costs will be in order of the individual categories (Unit Personnel, Unit Level Consumption, Contractor Support, Depot Field Requirements, Indirect Support, and Administrative and Planning), with CLSS and CLS costs addressed for a single category before continuing to the next category. The number of ABDR teams used in the category cost calculations will be five, the full complement of teams when the F-22 fleet is at full force. However, since the F-22 will not require five ABDR teams throughout its life-cycle, an expected value approach will be taken. For the final LCC estimate, all cost categories will be adjusted for the fact that there will not be five ABDR teams throughout the F-22s life-cycle. This adjustment will consist of multiplying the

category costs by the ETF. All reported costs are in dollars ($). Although prediction of wartime costs is not an objective, this study will illustrate potential cost scenarios which could exist if and when the USAF must deploy ABDR teams to a hostile zone. Finally, a sensitivity analysis will be conducted to evaluate "what if" scenarios. Before presenting the category analyses, a discussion on total costs and F-22 logistics support is warranted.

F-22 Life-Cycle Logistics Support Costs

Although the calculations in this chapter focused on individual ABDR cost categories, the overarching goal is to maintain a focus on F-22 total life-cycle logistics support costs. The reason for this focus is that the ABDR function is only one small portion of the total F-22 logistics support costs. Focusing only on ABDR costs would lead to a conclusion based on only one facet of the F-22 logistics support process—a sub-optimal approach. One source suggests that sub-optimal decision making can occur if sub-units within an organization do not realize the effects of their decisions on other sub-units within the organization (Horngren, et al, 1994). As a result, optimizing the F-22 ABDR function at the expense of the total F-22 logistics support costs would be inefficient and possibly very costly.

Peacetime Cost Calculations

The calculation of each category's peacetime costs will help illuminate the respective percentages of budget resources used by each category; as a result, the ABDR decision-maker will receive additional insight for making a final ownership decision.

Unit Personnel

Unit personnel costs include the costs associated with providing pay, allowances, and benefits to unit personnel. In addition, the costs for acquiring each service member in the unit and providing their initial skills training must also be accounted for.

The first element of unit personnel costs is composite pay (e.g., base pay, retired pay accrual, basic allowance for quarters, variable housing allowance, incentive and special pays, etc.); therefore, the Military Annual Standard Composite Pay chart—Table A19-1 from AFI 65-503—was used to cost the F-22 ABDR team described in Table 5 of Chapter 3. To calculate the annual unit personnel costs from composite pay, the annual composite pay for each ABDR team member (*Total Annual Composite Pay* in Table 8) was multiplied by the number of like-AFSC members (*#/Team*) and the number of teams (*Teams*). Again, the number of teams used for initial category calculations was the full complement of five ABDR teams. Once all category costs have been determined, a final adjustment will be made using the ETF. Table 8 summarizes the results of the composite pay element of unit personnel costs.

The second element reflects the costs of acquiring and initially training USAF service members. The enlisted members A&T costs were obtained from Attachment A18-1A of AFI 65-503, *Variable Cost By Enlisted Air Force Specialty Initial Skill Training*, lists a one time cost for each AFSC. This table lists the one time cost includes the following variable costs:

- cost per graduate for training courses required for a specific AFSC at the basic skill level,

Table 8. Annual Unit Personnel Costs - Composite Pay

AFSC	Rank	Total Annual Composite Pay	#/Team	Teams	Total Cost/ AFSC
ABDR Team					
2A353B	E5	$ 37,983	2	5	$ 379,830
2A373B	E6	44,441	1	5	222,205
2A372	E6	44,441	1	5	222,205
2A390	E8	58,915	1	5	294,575
2A654	E5	37,983	2	5	379,830
2A656	E5	37,983	1	5	189,915
2A676	E6	44,441	1	5	222,205
2A753	E5	37,983	4	5	759,660
2A773	E6	44,441	1	5	222,205
Sub-total			14		**2,892,630**
Engine Team					
2A651A	E5	37,983	2	5	379,830
Engineer					
062E3A	O3	74,424	1	5	372,120
TOTAL					**3,644,580**

- acquisition costs (including the costs of recruiting, initial travel, and initial clothing issued) and a cost for basic training at the USAF Military Training Center, and

- pay and allowances for leave accrued during basic training and formal training (AFI 65-503, 1996).

To obtain the officer A&T costs, the variable cost per graduate for United States Air Force Academy (USAFA), Reserve Officer Training Course (ROTC), and Officer Training Squadron (OTS) commissioning sources was used. The cost for education, obtained from the financial management department at the USAFA (USAFA/FM), was used for variable costs of the USAFA (Shaw, 1997). This is the cost the Academy reclaims from a cadet who drops out of the program (Shaw, 1997); therefore, it seemed rational to use this as a variable cost for A&T calculations. USAFA/FM also had the

number of graduates for 1995 (Shaw, 1997). The OTS variable costs and graduates were obtained from attachment 17 in AFI 65-503. Also from this attachment were the ROTC total costs and graduates. To obtain an estimate for variable costs, the OTS variable vs. total ratio of .70 was multiplied by the ROTC total costs. This ratio was obtained from the office of primary responsibility for the attachment. To obtain a final estimate of A&T costs per individual officer, the total commissioning costs were calculated, then, divided by the total number of commissioned officers. Table 9 gives the variable costs of each commissioning source, as well as the number of graduates for 1995.

Table 9. Annual A&T Cost/Commissioned Lieutenant (1995)

Commissioning Source	Variable Cost/ Graduate	Graduates	Total Cost
USAFA	$ 119,348	994	$ 118,631,912
ROTC	87,993	1,458	128,293,502
OTS	19,373	848	16,428,304
Column Totals		3,300	263,353,718
A&T Cost/Commissioned Lieutenant			**79,804**

In addition to needing the one time A&T costs, the active military turnover rates for the ABDR team members would be required in order to calculate an expected annual acquisition and training cost. Attachment 19 of the AFI supplied this information, and the result for enlisted members and non-rated officers was 10.25 and 6.95 percent, respectively. Although attachment 19 gave 1995 turnover rates, the slight inaccuracies which could result from the one-year old rates would be very small in comparison to the CLSS LCC. By multiplying the values in columns 3 - 6 of Table 10, annual A&T costs for each AFSC were obtained. Table 10 contains the results for the annual peacetime

A&T costs. Since the data were in 1995 then-year dollars, an adjustment had to be made using a weighted inflation index of .949. The *USAF Weighted Inflation Indices* page instructs users to use raw indices for Pay and POL [petroleum, oils, and lubricants] inflation ("USAF Raw", 1997). Although the A&T cost values do not represent PAY only, the slight error from using .949 would be negligible when compared to total costs. The final total of $189,152 was obtained by dividing the subtotal (the pre-inflated total) by the index.

Table 10. Annual Unit Personnel Costs - Acquisition & Initial Training (1995)

AFSC	Rank	A&T Cost	Freq. of A&T	#/Team	Teams	Annual A&T Costs
ABDR Team						
2A353B	E5	$ 26,870	0.1025	2	5	$ 27,542
2A373B	E6	26,870	0.1025	1	5	13,771
2A372	E6	19,730	0.1025	1	5	10,112
2A390	E8	16,587	0.1025	1	5	8,501
2A654	E5	11,574	0.1025	2	5	11,863
2A656	E5	19,913	0.1025	1	5	10,205
2A676	E6	19,913	0.1025	1	5	10,205
2A753	E5	17,806	0.1025	4	5	36,502
2A773	E6	17,806	0.1025	1	5	9,126
Engine Team						
2A651A	E5	13,606	0.1025	2	5	13,946
Engineer						
062E3A	O3	79,804	0.0695	1	5	27,732
Subtotal						179,505
				Raw Inflation Index (3500)		0.949
TOTAL						**$ 189,152**

The contractor will not carry a formal ABDR team during peacetime. Instead, various depot and production plant employees may be listed as ABDR-recognized

personnel, prepared to deploy for contingencies. In addition, the contractor would also hire additional aircraft technicians as needed. Any costs required to ensure the employees have the required skills and training, and remain deployable will be included in the *Administration and Planning* cost category. Therefore, no CLS costs will be itemized under unit personnel.

Unit Level Consumption

The 652nd CLSS's 1996 operating costs were used to obtain an estimate for F-22 CLSS Unit Level Consumption costs. Located at SM-ALC, the 652nd incurred operating costs which were for travel, supplies, vehicle fuel, and administrative materials (Voeghtly, 1997). These expenses obtained from one unit official are much like the typical elements found listed in the CORE description of unit level consumption. All other CORE-mentioned elements were negligible. Since the 652nd also supports two other MDSs—the A-10 and F-111—a method for allocating the operating expenses to the F-117 was required. A reasonable allocation base was the number of ABDR teams assigned to the squadron. The three weapon systems had the following number of teams: A-10 (5); F-117 (2); and F-111 (1). The total amount of ABDR teams in the 652nd CLSS is eight; consequently, the F-117 accounts for two out of the eight, for a total of approximately 25 percent of the operating expense. The total operating expenses for the 652nd during 1996 was $250,000—$200,000 supplied by Air Force Materiel Command and $50,000 supplied by the F-117 program (Voegtly, 1997). As a result, 25 percent of the AFMC-supplied funds and 100 percent of the F-117 funds were added to obtain the

operating expenses allocable to the F-117. To get an estimate for F-22 operating expenses, the F-117 operating expense was then adjusted by the ratio of F-22 to F-117 ABDR teams—or, 5:2. Table 11 shows the results.

Table 11. F-22 CLSS Operating Expenses

		A-10	F-117	F-111
ABDR Teams		5	2	1
652nd Operating Budget (1996)				
AFMC Supplied	$ 200,000			
Amount Allocated To:		$ 125,000	$ 50,000	$ 25,000
F-117 SPD Supplied	50,000		50,000	
Total		125,000	100,000	25,000
F-22 Operating Expense			**$ 250,000**	

The CLS costs for this category will be dealt with just as those in the *Unit Personnel* category were. Any operating expenses the contractor would incur will be evaluated under the *Administration and Planning* category. As a result, no costs will be included for CLS unit level consumption.

Contractor Support

Combat Logistics Support Squadrons are self-sufficient maintenance support units themselves; as a result, there are not many elements to consider for this category. The costs to develop the engineering data and technical manuals used for battle damage repairs is an element which could demand large initial investments and recurring costs for the USAF. The primary question is how much more expensive would it be for putting the engineering data and technical manuals into USAF format vs. contractor format? The Acquisition Logistics Integrated Logistics Support Handbook states that system maintenance by the contractor requires minimal technical manual development, whereas,

organic maintenance approaches require substantial technical manual development ("Acquisition", 1997). It is possible that this category could have a major impact on the incremental cost of the CLSS alternative. On the other hand, since the ABDR technical manuals and data are designed for field use, and the contractors would also have to use some kind of field manuals and data, another feasible likelihood is that these items are wash costs. That is what this study will assume.

Another possible contractor support cost would be if the contractor charged the future F-22 CLSS for training or facility and equipment use of the contractor's depot facilities. One of the potential F-22 CLSS sites would be Warner-Robins ALC. Located there, the CLSS ABDR personnel would have to travel up to the contractor's depot facility, located at Marietta, Georgia in order to receive critical training. And, unless the original depot contract requires unlimited access and training for CLSS personnel at the contractor's depot, the CLSS can expect to incur additional contractor support costs. With or with out this agreement, the USAF will most likely pay for sending CLSS teams to the contractor's depot for training. However, since there have been no formal decisions made on the future location for F-22 ABDR teams, this study will not include any costs for the contractor logistics support category.

Depot Field Requirements

During this study, numerous investigations were being conducted on the efficiency of DoD depots, and future logistics support contracts were undergoing competition. Consequently, pertinent data for this category was unavailable, as

contractor and certain CLSS DFR costs were either proprietary in nature or highly guarded. As a result, definitive calculations were not possible for the Depot Field Requirements category. However, qualitative analysis of DFR costs can be accomplished.

As described earlier, the peacetime role of the CLSS includes depot field repair work. These field repairs are performed by either the CLSS, depot civilians, or contractor personnel, where the order of precedence for which one performs the field repair is CLSS, depot civilians, then contractors (Krontz, 1997). The CLSSs are the preferred method because organic ABDR personnel are able to receive additional heavy maintenance training and experience, and the CLSSs appear to be the least-expensive alternative (Krontz, 1997). There are two primary reasons why contractors appear more expensive. First, since CLSS personnel are already paid for, their personnel costs are sunk (in the short run) and would seem to not require inclusion in any DFR cost estimates. Second, contractor labor rates are consistently higher than CLSS labor rates. The importance of that became more apparent after reviewing labor rates in a DFR cost report performed by the 652nd CLSS. Other CLSS personnel have also stated that contractor labor rates are much higher, which leads to the conclusion that the labor cost element appears to provide a very large potential for cost differences between the CLSS and contractor teams. Most other cost elements (e.g. per diem, travel, transportation, and housing) could be considered wash costs, or negligible when compared to labor. Therefore, since the driving cost element of DFR costs is labor, the contractor alternative appears much more expensive.

The two reasons why contractor labor appears more expensive are not valid when considering a life-cycle approach focused on the long run and *total F-22 logistics support costs*. Addressing the first reason, in the long run CLSS personnel costs are not sunk. As a result, the CLSS DFR rates will be more comparable to the CLS rates. When analyzing the second reason, a discussion of fixed and variable costs as they apply to F-22 LCC is appropriate. When businesses charge for labor, they include a portion of their total overhead into their labor rate. And, "overhead costs are a major component of the total costs in most organizations" (Horngren, et al., 1994).

One good example of how large the proportion of overhead is to real labor is in the electronics industry. In this industry, the rate of manufacturing overhead rates vs. manufacturing labor is from 2.13 to 3.95 (Horngren, et al., 1994). The labor rates charged by contractors for DFRs could also become quite high because the overhead costs are based on very large initial investments often required with development of major weapon systems. The important consideration is that the USAF is likely going to be charged the overhead of the depot contractor whether the charge is placed on contractor DFRs or on production F-22s. The DFRs will not create any additional overhead costs to the contractor; therefore, any costs incurred by the contractor doing DFRs will be variable costs.

The next three figures are presented only to demonstrate the effects of overhead allocation. The cost numbers in the figures are not authentic; they are simply used to facilitate the demonstration. That is, they are simply unitary representatives of hypothetical totals. Figure 2 demonstrates a potential scenario of F-22 DFR costs.

Notice how much more expensive the CLS alternative appears. Also notice that the CLS alternative includes a portion of depot fixed (DF) costs allocated to it. The reason why the DFR Variable amounts are different between the alternatives is due to the CLSS alternative not having a labor component. The total DFR costs for CLS in Table 8

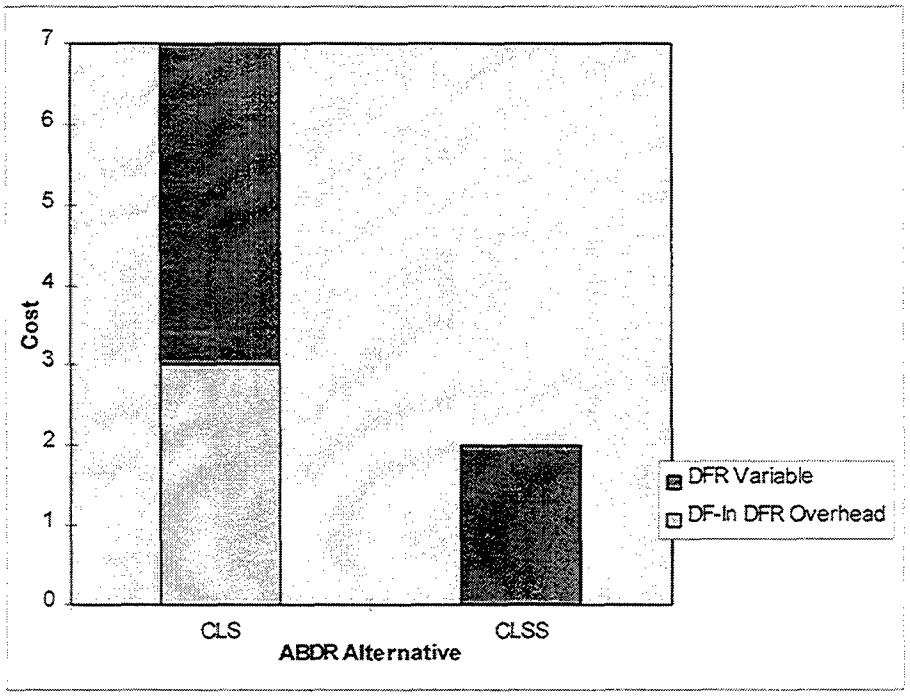


Figure 2. F-22 Hypothetical DFR Costs

includes a DFR Variable component (including labor—minus the DF costs-allocated portion, per diem, travel, transportation, and housing) and the itemized allocated portion of the DF costs, or overhead. The CLS total DFR cost looks much more expensive than the CLSS. In Figure 3, all other CLSS costs (e.g., unit personnel, indirect support, acquisition and training) are added to the CLSS alternative. Again, the cost numbers in the figure are not authentic. However, even with the other CLSS cost components (i.e., categories), it still appears that the CLSS are less expensive. This scenario would

represent a situation where the DFR costs were quite large in respect to the other CLSS costs. From this figure, the CLSS alternative would remain the best choice. Finally, the

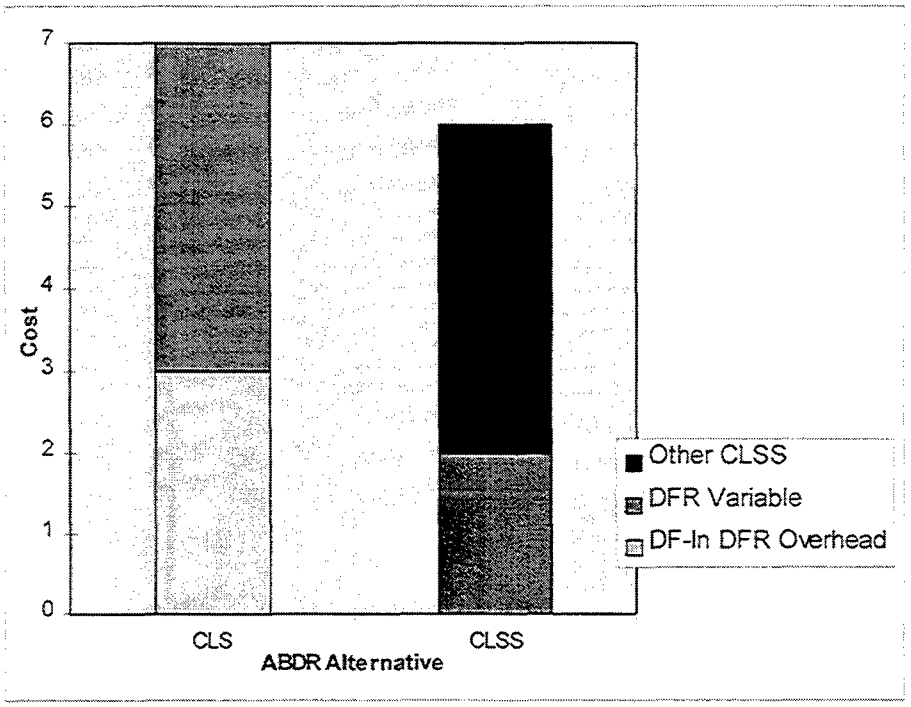


Figure 3. Hypothetical F-22 DFR Costs With Other CLSS Costs

DF costs must be added to obtain a total F-22 logistics support cost scenario. Since depot variable costs and organizational-level maintenance costs in the active units would both be wash costs, they are left out of the total cost picture. By adding the DF costs, the best alternative in this scenario would be the CLS (Figure 4). The reason lies in the fact that a portion of the DF costs had already been added in the CLS alternative, leaving the remainder to be added for this final figure. On the other hand, all DF costs had to be added to the CLSS alternative. This last scenario represents the reality of overhead costs in the F-22 total weapon system logistics support. Based on the manufacturing overhead

vs. manufacturing labor rates in the electronic industry, this scenario is not unreasonable for the ABDR case. Of course, in the real scenario, many other factors will have an influence. For instance, if the depot has capacity, it is likely that the CLS alternative

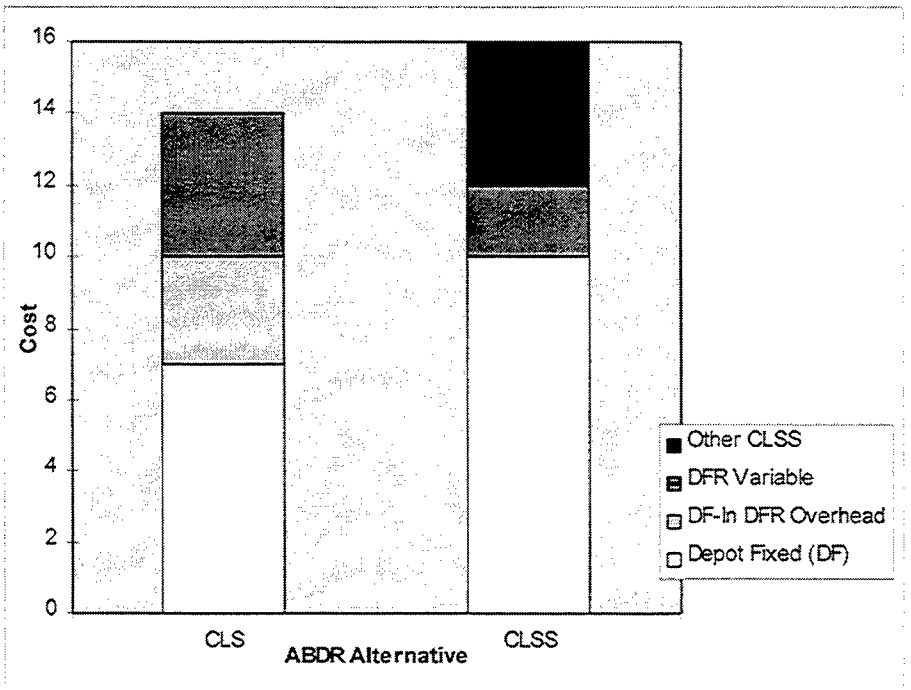


Figure 4. Hypothetical F-22 Costs With CLSS Other Costs & Depot Fixed Costs

will reap the benefits of economies of scale for DFRs, thus, providing another incentive for pursuing that alternative.

One possible economic benefit from using CLSSs would be if the CLSSs provide enough competition to the contractor to drive down DFR costs for the USAF. On numerous occasions the contractor has reduced their quote in order to win the contract for a field repair (Krontz, 1997). On the other hand, if the contractor also performs the depot function for the USAF, will reduced DFR contracts cause increased depot costs? Furthermore, it is quite possible that F-22 depot field repairs will require the most

advanced technological abilities, and that the contractor may be assigned the job anyway. As shown in Chapter 2, this is one primary reason—in addition to lower cost—why contractors are used for logistics support of military weapon systems.

Whether or not having a CLSS would provide competition to the contractor, and on how many repair jobs would the contractor be forced to compete is a difficult question. Some might profess that the CLSS would save the USAF exorbitant costs by competing with the contractor; however, if the contractor is *destined* to do certain field repairs anyway, there is no cost savings. It is this last issue which makes costing the depot field requirements category more difficult. One method to determine the actual price the future contractor would charge the USAF for performing a field repair without competition would be to obtain cost information from the B-2 program. The B-2 program presently relies on the contractor for all DFRs. Unfortunately, no B-2 data was accessible for this study; thus, no estimate for DFR costs was made. The important point is that DFRs encompass a very large proportion of peacetime ABDR team costs; consequently, the future ABDR decision-maker should bear this in mind, and make adjustments to the bottom line once more data is available.

Indirect Support

Indirect support (IS) includes the costs of personnel not directly assigned to the unit being supported. IS is supplied for purposes of personnel and installation support, whereby, the supporting personnel are not part of the supported unit, and would not be required if the unit moved elsewhere (AFI 65-503, Atch A54-1, 1994). The Cost

Analysis Improvement Group (CAIG) supplies the following as examples of IS: specialty training, permanent change of station (PCS), medical support, base operating support (BOS), and real property maintenance (RPM) ("CAIG", 1992).

To obtain an estimate of CLSS IS costs, data from the USAF VAMOSC data system were used to develop a cost factor. This approach was taken for many reasons, including that "the VAMOSC system is an information system which captures, calculates and reports historical operating and support costs of Air Force weapon systems" (AF VAMOSC, 1996). In addition, one VAMOSC objective is to "provide cost information to improve logistics policy decisions" (AF VAMOSC, 1996). Finally, one source suggested that a thorough cost analysis should include a combination of the USAF cost factors from AFI 65-503 and the cost data from the VAMOSC data system (Schank, et al., 1990). The source suggests that the VAMOSC data is more specific to a certain weapons system, while the cost factors are more general and from an aggregation across all weapon systems (Schank, et al., 1990). Table 12 lists the VAMOSC MDS and years used for calculating the F-22 IS costs, as they would relate to mission personnel. The MDSs chosen (F117, F15, F16, and A10) for comparison provide a good representation of potential F-22 IS costs. Both 1994 and 1995 cost reports were used to decrease the likelihood that one year reflected a peculiar cost behavior. Appendix A contains an example VAMOSC cost report for FY95 F-16D costs.

To obtain the F-22 CLSS IS costs, a ratio between the VAMOSC reported IS and mission personnel costs was formed. However, one modification to the IS costs was required. The VAMOSC IS costs included a component for specialty training costs, a

component which was quite large in some cases, as Table 12 illustrates. Since the CLSS acquisition and training costs were known from earlier (Table 10), and much smaller, the VAMOSC specialty training component was removed from IS cost consideration. Another issue was the relative size of each MDS program. The costs varied between MDSs; therefore, ratios for each MDS and year were weighted using mission personnel costs as the weighting factor. The resulting IS/MP factor was .72.

Table 12. Calculation of IS/MP Ratio

	MDS	Indirect Support (IS) Total	Specialty Training	Mission Personnel (MP)	IS/MP Ratio (w/o trng)
1995	F117	$ 62,883,415	$ 13,587,212	$ 57,073,148	0.86
(CMB)	F15E	152,521,088	34,587,728	140,323,640	0.84
	F15D	17,213,081	4,913,503	22,361,958	0.55
	F15C	175,548,976	47,995,323	217,170,807	0.59
	F16D	45,661,793	10,705,846	46,037,060	0.76
	F16C	284,672,706	67,041,984	287,908,109	0.76
	A10A	96,900,918	24,949,918	107,250,816	0.67
1994	F117	56,843,181	11,126,497	54,021,164	0.85
(CMB)	F15E	120,120,408	25,025,642	118,607,734	0.80
	F15D	21,070,479	4,359,765	24,238,470	0.69
	F15C	189,187,095	42,543,580	233,040,100	0.63
	F15B	1,536,387	284,269	2,199,508	0.57
	F15A	5,838,327	1,002,574	7,781,069	0.62
	F16D	46,790,174	9,279,336	47,592,646	0.79
	F16C	312,273,517	64,969,172	330,976,690	0.75
	F16A	397	188	827	0.25
	A10A	43,810,636	10,553,022	55,474,320	0.60
			Weighted Average		**0.72**

By using the estimated F-22 CLSS unit personnel - composite pay costs as mission personnel costs and multiplying it by the IS/MP ratio, an estimate for F-22 CLSS IS costs

can be made. The result is that CLSS indirect costs for the F-22 will be $2,620,905 each year.

Table 13. F-22 Indirect Support Cost

F-22 Mission Personnel	$ 3,644,580
IS/MP Factor	x 0.72
F-22 Indirect Support Cost	$ 2,620,905

Indirect support costs are a result of having an existing organization which utilizes other resources for support. Since the contractor will not have a standby ABDR team, only a database of qualified individuals to select from when needed, no indirect support costs will be incurred during peacetime operations. Any other peculiar costs incurred from using CLS will be included in the *Administration and Planning* category.

Administration & Planning

This category was included in order to itemize the costs incurred by choosing the CLS alternative only. Cost elements used for this category were based on the Army's LOGCAP program costs. This is logical since LOGCAP and ABDR requirements are very similar. Both programs require personnel to deploy to hostile regions, where individuals must be prepared for any of the following: physically rigorous conditions, chemical warfare, international laws (e.g., Law of Armed Conflict), etc. Typical peacetime costs would include a firm-fixed price contract for the contractor to formulate contingency plans and maintain a database of technically qualified and rapidly available individuals. Even though the contractor will not have standby ABDR teams, contingency planning must be done on a continual basis to ensure readiness. The Army recently

signed a new firm fixed price contract with Dyncorp. The payment Dyncorp received (for this non-deployed status contract) was for administrative and planning reasons, including: developing worldwide management plans, generic developed and undeveloped country management plans, regional management plans, and a database of technically and physically qualified individuals. The elements included in the contract price included any direct expense related to performing the plan (Eby, 1997). Example costs were direct expenses related to travel, per diem, transportation, and labor costs of the personnel conducting the contingency planning (Eby, 1997). The contract prices for these tasks, and the total LOGCAP fixed costs are shown in Table 14.

Table 14. LOGCAP Fixed Costs - Initial Year

Task	Quantity	Cost	Task Cost
Worldwide Mgt Plan	1	$1,377,800	$1,377,800
Country Mgt Plan	2	93,806	187,612
Regional Plan	9	44,520	400,680
Total LOGCAP Fixed Costs			**$ 1,966,092**

As a result, it is feasible that peacetime administration and planning costs for the ABDR contractor could be quite high. However, contingency planning for ABDR would probably not be as extensive as that required for LOGCAP. If this held true, the contract price would be less expensive than the LOGCAP price in Table 14.

Additional costs which may be added for ABDR could develop as a result that the ABDR mission is quite different from LOGCAP's. Aircraft maintenance on the F-22 will be a much more complex issue then the LOGCAP contractor's typical requirements of base camp construction, supplying laundry services, and food service and supply. As a

result, any required battle damage repair training for contractors would be an additional expense during peacetime. Also, exercises requiring contractor participation would be an additional cost. LOGCAP contractors required to participate in Army exercises are contracted on a cost plus award fee basis. A comparison would have to be made between the cost of having CLSS teams vs. CLS teams to participate in exercises. That comparison is left for future research.

Peacetime Life-Cycle Totals

The final peacetime life-cycle totals represent an estimation of the opportunity cost of a CLSS when five ABDR teams are required. However, a more likely scenario would be a slow build-up of ABDR teams to coincide with the F-22 fleet size, followed by a tapering off of teams. Table 2 represents the most recent F-22 aircraft acquisition schedule, and a corresponding feasible ABDR team ramp-up schedule. These values were used to calculate the ETF, which was multiplied by the peacetime life-cycle cost to obtain an adjusted peacetime LCC. Table 15 below shows the final total LCC for CLSS.

Table 15. Adjusted Peacetime CLSS Life-Cycle Costs

Cost Category	CLSS
1. Unit Personnel	
Composite Pay	$ 3,644,580
Acquisition & Skills Training	189,152
2. Unit Level Consumption	250,000
5. Indirect Support	2,620,905
Peacetime Annual Cost	**6,704,637**
Peacetime Life Cycle Cost	207,843,746
Expected Team Factor	0.8645
Adjusted Peacetime LCC	**$ 179,684,271**

Of course, the assumptions used for obtaining this total excluded any negligible costs or wash costs. Therefore, this amount represents the opportunity cost for having a CLSS, *as opposed* to using CLS, and it is not a CLSS LCC total, per se. This point is very important, and any decision made should reflect it. In addition, the appropriate decision-maker is alerted to the fact that three of the categories have been removed due to insufficient data. A sensitivity analysis will help alleviate the uncertainty which exists by exposing the worst and best case scenarios involving the known category elements. This analysis will be done after potential wartime cost scenarios are examined.

Wartime Cost Calculations

One of the biggest costs incurred by using contractors is likely to be for deploying them to a hostile zone. This study uses the assumption that contractor ABDR teams will be more expensive to operate during a deployed situation, for either an actual war, Military Operation Other Than War (MOOTW), or other contingency. While an attempt to estimate the costs of employing CLSS or CLS teams during these contingencies would be highly speculative, it is very important to consider the effects on the total F-22 ABDR life-cycle cost, in light of how frequently the USAF must deploy ABDR teams to hostile zones.

Frequency of Hostile Conditions Requiring ABDR Team Deployment

To obtain an idea of the effects of contingency operations on LCC, the following two parameters were varied: (1) the ratio between costs of deployed CLS and CLSS ABDR teams, called the War Cost Factor (WCF), and (2) the percent at war (PAW), or the

"percentage of the F-22 lifetime spent at war." The PAW values evaluated included a range from 0-50 percent. Because predicting future wars that the USAF will be involved with is near impossible, this range was used to ensure all feasible possibilities were included. Since the purpose of this study is to evaluate *incremental* costs, any sunk or wash costs which would exist will not be included. The primary cost category to consider then becomes the unit personnel category, since personnel pay and benefits will be the most likely elements where CLS is likely to cost much more than CLSS during a deployment. Understanding that CLS costs would be arranged in aggregate through a contractual instrument, thus, difficult to assess, for this study the unit personnel - composite pay element will be the foundation for wartime costs.

Table 16 provides the *incremental* costs—e.g., the excess costs realized—of using CLS as opposed to CLSS teams during deployments to hostile zones. The table utilizes the two recently introduced parameters, War Factor and PAW. The WCF represents the

Table 16. Incremental Costs of Deployed CLS vs. CLSS

WCF	PAW	0	5	10	15
(cls - clss)/clss	CLSS Cost	0	$ 5,025,523	$ 10,051,046	$ 15,076,569
0		0	0	0	0
0.1		0	502,552	1,005,105	1,507,657
0.2		0	1,005,105	2,010,209	3,015,314
0.3		0	1,507,657	3,015,314	4,522,971
0.4		0	2,010,209	4,020,418	6,030,628
0.5		0	2,512,762	5,025,523	7,538,285
1		0	5,025,523	10,051,046	15,076,569
1.5		0	7,538,285	15,076,569	22,614,854
2		0	10,051,046	20,102,092	30,153,139
2.5		0	12,563,808	25,127,616	37,691,423
3		0	15,076,569	30,153,139	45,229,708
3.5		0	17,589,331	35,178,662	52,767,993
4		0	20,102,092	40,204,185	60,306,277
5		0	25,127,616	50,255,231	75,382,847
10		0	50,255,231	100,510,462	150,765,694

percent or factor difference between CLS and CLSS costs—a simple relationship given by the following equation:

$$\frac{\text{CLS} - \text{CLSS}}{\text{CLSS}}$$

Therefore, if CLS wartime costs were $200 and CLSS were $100, the WCF would be 1. One source reporting on contractor technical representatives serving on a Navy aircraft carrier said that the government pays technical representatives about twice what it does its own technicians (Denny, 1985). This report provided justification for varying the war factor from 0 to 10 in this study. The factor was varied up to 10 just to add a "worse-case" scenario view.

The PAW represents the percentage of the weapon systems' life-cycle where the USAF will have ABDR teams deployed in a hostile zone. So, if ABDR teams were deployed 73 days out of each year, the PAW would be 20 (percent)—73 out of 365 days. It should be understood that the PAW values in this study do not delineate whether or not the entire ABDR team is deployed. It's possible that only the BDR or Engine team would deploy, as opposed to both deploying. As a result, the PAW gives a "worst case" scenario—it assumes all team members are deployed—and the values in the table would be less if the entire ABDR team did not deploy.

To help with understanding this analysis, the steps for calculating the CLSS wartime personnel costs will be included. Since military personnel receive imminent danger pay, certain places pay (formerly known as foreign duty pay), and family

separation pay when sent into contingencies (GAO 96-115, 1996), the CLSS unit personnel costs were increased by 10 percent to account for increased wartime costs. Hence, in a hypothetical wartime scenario, personnel cost for using CLSSs would be calculated using the following steps:

1. Obtain the annual peacetime unit personnel (composite pay) CLSS costs;
2. multiply this cost by the ETF;
3. multiply this value by the operational lifetime of the F-22 (29 years);
4. adjust this value for wartime scenario by multiplying by 1.1; then,
5. multiply this value by the PAW and divide by 100.

For the base case, using a PAW of 20 percent, the CLSS wartime personnel costs are $20,102,092 (shown in Appendix B). The resulting incremental costs using a WCF of 1 would be $20,102,092. Again, all other costs are considered wash costs, and the only major cost difference between CLSS and CLS during war is assumed to be the personnel costs. Appendix B contains incremental CLS deployment costs for PAW values ranging from zero to 50 in increments of five percentage points.

Life-Cycle Totals With Wartime Scenario Included

To illustrate the potential effect of wartime costs, the incremental CLS wartime LCC costs were added to the peacetime CLSS LCC to obtain a final ABDR LCC. A PAW of 20 percent and a War Factor of 1 were used for this example, and the total can be found in Table 17.

Table 17. CLSS LCC With War Scenario

Cost Category	CLSS
1. Unit Personnel	
Composite Pay	$ 3,644,580
Acquisition & Skills Training	189,152
2. Unit Level Consumption	250,000
5. Indirect Support	2,620,905
Peacetime Annual Cost	**6,704,637**
Peacetime Life Cycle Cost	207,843,746
Expected Team Factor	0.8645
Adjusted Peacetime LCC	**179,684,271**
% At-War	20
War Factor	1
CLS Marginal War Cost	**(20,102,092)**
ABDR FINAL LCC	**$ 159,582,178**

Sensitivity Analysis

Since uncertainty is always present in economic decision making, a sensitivity analysis should be performed (DODI 7041.3, 1995). "Sensitivity analysis is a repetition of an analysis with different quantitative values for cost or operational assumptions to determine their effects for comparison with the results of the basic analysis" (DODI 7041.3, 1995). This analysis is a "what-if" exercise to test whether or not the conclusion will change if the cost, benefit, or other assumed variables change (DODI 7041.3, 1995).

In this study, the variables evaluated for their sensitivity were the number of technicians/ABDR team, the IS/MP ratio, and the ETF. To give a depiction of what a CLS contract would have to fall under to be the more cost effective alternative, the incremental CLS war LCCs were also calculated and subtracted from the resulting CLSS LCC. In addition, many combinations of the three key variables were evaluated. For example, for the least expensive CLSS alternative, the following variables were used: (1) an ABDR team composition including only one individual from each AFSC (a total of 11

on this hypothetical team), (2) the lowest IS/MP ratio from Table 12, and (3) an ETF of .6 (or, an expected number of ABDR teams of three). The reason the IS/MP ratio was used at values of .55 to .86 was because those two values represented the worst and best case IS/MP ratios from Table 12. The extreme values for the two other parameters, ETF (.6 and 1.0) and #/team (11), were chosen just for illustrating their effect on the LCCs. The other combinations used, and their effect on the final Δ (CLSS LCC- Incremental CLS War LCC) are shown in Table 18.

Table 18. F-22 ABDR LCC Sensitivity

Varying Cases	CLSS Cost Annual	LCC	Incr. CLS War LCC	Δ
WCF - 1				
Base Case	**$ 6,704,637**	**$ 179,684,271**	**$ 20,102,093**	**$ 159,582,179**
1. #/Team (11)	4,688,755	125,658,639	13,817,107	111,841,532
2. IS/MP (.55)	6,088,251	163,165,127	20,102,093	143,063,034
3. IS/MP (.86)	7,218,071	193,444,303	20,102,093	173,342,211
4. Expect. Teams (3)	6,704,637	124,706,248	13,951,452	110,754,796
5. Expect. Teams (5)	6,704,637	207,843,747	23,252,421	184,591,327
5. 1 & 2	4,265,084	114,304,260	13,817,107	100,487,153
6. 1 & 3	5,041,662	135,116,547	13,817,107	121,299,440
7. 1 & 4	4,688,755	87,210,846	9,589,485	77,621,362
8. 1 & 5	4,688,755	145,351,405	15,982,474	129,368,931
9. 2 & 4	6,088,251	113,241,468	13,951,452	99,290,016
10. 2 & 5	6,088,251	188,735,780	23,252,421	165,483,360
11. 3 & 4	7,218,071	134,256,117	13,951,452	120,304,665
12. 3 & 5	7,218,071	223,760,194	23,252,421	200,507,774
13. 1,2,& 4	4,265,084	79,330,568	9,589,485	69,741,084

Notice that the least cost CLSS alternative (last shaded row) has a LCC of $79,330,568 (excluding any negligible costs or wash costs). As stated before, this amount represents the opportunity cost for having a CLSS, *as opposed* to using CLS. The usefulness of this number is that the ABDR decision-maker now has a virtual ceiling

for how high a contractor proposal can be in order to be the most cost-effective alternative. Table 18 also includes the possible scenario which includes incremental CLS wartime costs. All estimates for this value are based on, (1) the ABDR teams being deployed for 20 percent of the F-22 Lifetime, and (2) a WCF of 1. Again, a WCF of one represents a scenario where the CLS wartime personnel costs are twice that of the comparable CLSS costs (e.g., war factor of 1 means multiply the CLSS cost by 1 to get excess CLS costs). The final result is that total CLS peacetime LCC must be less than $69,741,084 in order for outsourcing to be more cost effective (Appendix C includes the same sensitivity results, using WCFs of 2, 3, and 4).

The other extreme came (first shaded row) from using an ETF of one and an IS/MP ratio of .86. The resulting opportunity cost with and without CLS wartime costs included is $223,760,194 and $200,507,774, respectively. The IS/MP ratio used here is based on the 1996 F-117 costs reported by VAMOSC. Considering that the F-22 is most technically similar to the F-117, it is possible that this ratio will be more likely than the others. However, a thorough analysis of indirect support costs and their respective cost drivers would have to be done to resolve this issue. That analysis is left for future research.

Conclusions

This chapter addressed question two of Investigative Question Set 2. Question two asks:

- *How would CLS and CLSS ownership strategies compare financially?*

Unfortunately, key data was unavailable for making an estimate of the CLS alternative; however, this chapter did estimate the cost of having an F-22 CLSS. In addition, potential cost scenarios for the CLS alternative were also evaluated. Since the F-117 is an analogous weapon system, F-22 costs relied heavily on the F-117 ABDR team composition.

The GAO reported that personnel reduction is a primary reason for budget savings when using outsourcing (GAO 97-86, 1997)), and the unit personnel costs of the CLSS validated this report. The CLSS unit personnel total annual costs, with the full complement of teams, was $3,644,580 and $189,152 for composite pay and A&T elements, respectively. The other pertinent F-22 ABDR cost categories, Unit Level Consumption and Indirect Support, will cost the USAF $250,000 and $2,620,905, respectively, annually. By using the ETF to account for the gradual ramp-up of ABDR teams, the total adjusted peacetime LCC for the CLSS will be $179,684,271. It is important to note that this CLSS LCC reflects the absence of any Contractor Support or DFR category costs, and any costs considered negligible or wash in the initial assumptions (e.g., equipment and facility costs).

When evaluating potential CLS costs, the primary excess costs will be for administration and planning, exercises, and incremental wartime costs. The Army pays a firm-fixed price each year to have a contractor administer and plan for LOGCAP contingencies. The recently signed contract was worth $1,966,092 to the contractor; however, it is unlikely that the CLS ABDR contract would be this expensive. The LOGCAP program is much larger than what the ABDR program would be; therefore,

direct costs for contingency planning and database administration should be smaller. And even if CLS costs rise because of exercise requirements, they should not be much higher than the costs for sending CLSS teams on the exercise.

Finally, contractor costs are known to be much higher than military personnel costs during wartime or contingency operations, and numerous WCF scenarios were addressed. One scenario supposed that the USAF would be required to deploy ABDR teams for 20 percent of the F-22 lifetime. In addition, this scenario assumed that contractor personnel costs would be twice that of military personnel (WCF of 1). Even with the potential war scenario cost differential added, the CLSS alternative still resulted in a total incremental LCC of $159,582,178. The importance of this number is that the appropriate ABDR decision-maker now has a virtual ceiling for how high a contractor proposal can be in order to be the most cost-effective alternative. The results of the CLSS costs show that the CLS alternative has much potential.

The sensitivity analysis resulted in substantial changes in the final opportunity costs of the CLSS. With a war factor of 1 and a PAW of 20 percent, the opportunity costs of the CLSS, minus the incremental CLS wartime costs, ranged from $69,741,084 to $200,507,774. The biggest driver was the size of the ABDR teams; however, the IS/MP ratio and the ETF also had major impacts on the results. The important concern is whether the DFR, Contractor Support, and Administration and Planning cost categories will result in a higher CLS result. Deterministic estimations were not possible for these categories; therefore, future research will make this clear.

The mission of the CLSSs is to provide various levels of "maintenance and modifications, crash recovery, crash damage repair, and ABDAR on aircraft and aircraft systems to improve aircraft fleet readiness" (AFMCI 10-202, 1997). The operative word in this mission statement is *readiness*, and being a combat support unit of military personnel, the CLSSs are well prepared for ensuring the USAF has a ready ABDR capability. Unfortunately, this capability comes at a price, and the results of this chapter show that the USAF incurs a substantial opportunity cost for having CLSSs. Since ABDR during hostile conditions is not something our country is faced with very often, the opportunity costs of having a full-time force prepared for that contingency gives rise for pursuing the CLS alternative.

5. Conclusions and Recommendations

Introduction

The purpose of this chapter is to present the conclusions and recommendations of the study. First, the *Specific Problem* and the *Purpose of the Study* will be presented. Then, the limitations of the study will be provided in order to clarify what conclusions can be made. Subsequently, each investigative question will be discussed and a conclusion drawn. Once the questions and conclusions have been presented, recommendations for the F-22 ABDR CONOPS will be furnished. The incorporation of an integrated product team (IPT) organization for F-22 ABDR will be suggested, followed by recommendations for future research. Finally, a summary of the study will be presented.

Specific Problem

What ABDR ownership strategy, between CLS and CLSSs, would best serve the USAF? In investigating this problem, what justification exists for using contractor personnel for F-22 ABDR, and how would the two ownership strategies compare economically?

Purpose of the Study

The purpose of this study is to evaluate crucial ABDR ownership questions in order to determine whether CLS is a viable alternative to CLSSs for providing the F-22

ABDR function and provide a recommendation for which alternative is best for the USAF.

Limitations of this Study

While much data has been collected for this study, key contractor and CLSS data were unavailable. In addition, no attempt was made to quantify the benefits of either alternative. As a result, a formal economic analysis was not possible, and the reader is warned of this. This study only provides an initial estimate of the cost of having an F-22 CLSS and explores the potential cost drivers of the CLS alternative.

Review of Investigative Questions - Set 1

Question 1

- *Does the law preclude using contractor civilians for F-22 ABDR?*

Since DoD has made no determination on ABDR as a core logistics function, it is difficult to provide a definite answer to this question. Nevertheless, since US Congress expects the SECDEF to make the determination of what is core, and also provides the SECDEF waiver authority to outsource core functions, the legality issue appears to have been resolved when one considers the number of times that DOD has deployed contractors to a hostile zone. Actions do not make something legal, however, when our written laws are vague or based on judgment, precedence plays a role in establishing the law. In fact, sending 36 contractor personnel into Iraq during the ground war, an act which undoubtedly put those individuals in harm's way, is one indicator of how DoD leaders interpret the laws. And the DoD departments are continuing to plan for contractor

use during contingencies. As long as DoD maintains a logistics capability as the US Code requires, use of contractor personnel in hostile zones must be deemed legal.

Question 2

- *Is ABDR considered an intrinsically governmental function, thus, off limits to outsourcing?*

The OMB criteria for a function being considered inherently governmental and off-limits to outsourcing is suspect. The category of the definition which ABDR might fit under—the act of governing—contains two questionable aspects. The first aspect, the notion that any function which requires personnel to deploy in a combat, CS, or CSS role cannot be outsourced is directly in conflict with past and present programming. In addition, the definition implies that functions which already employ other-than military personnel would be open to outsourcing, whether deployment was a requirement or not. The current employment of contractors, for deployment or otherwise, should not make a difference. Despite the ambiguity of the definition, the continued use of contractor personnel in contingencies by DoD testifies to the usefulness and viability of outsourcing ABDR.

Question 3

- *Do DoD or USAF manning criteria preclude using contractor civilians for F-22 ABDR?*

The DoD requirements for maintaining a position as military are based on: law; combat readiness, training, and military background; security; discipline; rotation; and

unusual duty hours. These criteria do not definitively rule out the use of CLS for F-22 ABDR. In each case, a criterion was ruled as: obsolete by the GAO (e.g., rotation and unusual duty hours); was not applicable to the situation (e.g., discipline), or; requiring a judgment call (Specifically, what exactly determines being combat ready?). While some officials may believe CLSS is the unquestionable choice, the answer to the third investigative question is unclear because DoD and USAF regulations are vague and sometimes contradictory.

If F-22 ABDR is considered a direct CS function, then USAF guidance requires that it be declared ME. However, if F-22 is an indirect CS function, the AFIs are unclear and contradictory. AFI 38-204 provides four different solutions to the manning question, and seems to disregard the content of AFI 36-507. Meanwhile, USAF policy also suggests outsourcing a CA if it is more cost-effective and does not compromise the mission. The past examples have shown that contractors have been very reliable, and their performance evaluations have reflected that. In addition, DoD budget officials have warned us that unnecessarily diverting scarce budget resources (or, choosing the least cost-effective alternative) will ultimately lead to a "decline in military readiness and combat power" (Maze, 1997).

Question 4

- *When the United States Air Force is directed into combat, would CLS civilians remain on duty during hostilities, and would their performance be up to Air Force standards?*

Examples this study provides of historical precedence, present plans, and the comments of numerous reputable sources demonstrate that contractors can and will perform even in hostile conditions. Furthermore, LOGCAP award fee history adds even more credence to the idea that contractors will be responsive and perform up to standards when performing ABDR. Finally, the implications of a termination for default provide strong motivation for a contractor to perform as expected.

To minimize confusion over what is expected of a contractor, DoD planning activities must ensure they identify services designated as ME in the contract SOW. Contractors can only provide a similar level of responsiveness as military assets (both personnel and materiel) "through the most careful drafting of contract requirements (the SOW), choice of contract type, and contract administration" (AR 700-137, 1985). As long as needs determinations are thorough and explicitly stated in the SOW and the contract is carefully administered, there is no reason not to believe that F-22 ABDR contractors will perform admirably when deployed. Supporting this reasoning, Major General Jim Childress, Commander of San Antonio ALC (SA-ALC), stated that as long as contractors have an understanding of their responsibilities, they will be reliable and can be expected to deploy and perform well during contingencies (Childress, 1997).

Question 5

- *What are DoD's future priorities, and how do they apply to the ABDR ownership decision?*

In March of 1996, the DoD submitted *Improving the Combat Edge Through Outsourcing* to Congress, a report outlining the three major challenges facing the DoD in the post-Cold War era. The DoD identified these three challenges as: *readiness, quality of life* [for our military members], and *modernization* (DoD Report, 1996). Through various initiatives, the DoD hopes to improve readiness, generate savings for modernization, and improve the quality and efficiency of support to the warfighters (DoD Report, 1996). However, DoD budget officials have warned us that unnecessarily diverting scarce budget resources will adversely affect our capability to modernize our forces, ultimately leading "to a decline in military readiness and combat power" (Maze, 1997). In other words, the DoD is searching for "best value" alternatives; consequently, if contractors can provide "best-value" ABDR, they should be considered a viable alternative.

Review of Investigative Questions - Set 2

Questions 1 and 2

- *What ABDR cost elements exist which should be included for cost analysis of how using CLS vs. CLSSs compares financially? and,*
- *How would CLS and CLSS ownership strategies compare financially?*

While much of the data required for the economic analysis was unavailable, the existing data demonstrates that there is a substantial opportunity cost for maintaining a CLSS. In light of that opportunity cost, the costs for CLS have the potential to be much lower than that of the CLSS option, even though the CLS alternative also comes at a

price. Table 19 shows the adjusted peacetime LCCs for the F-22 CLSS. Bear in mind that costs categories 3, 4, and 6 could not be calculated due to insufficient data, and therefore are not included in the final estimate. In addition, the peacetime LCC for the CLSS does not include other costs which were assumed to be wash or negligible costs between the two alternatives. Adjusted peacetime LCC in Table 19 reveals how high a contractor proposal can be and still remain the most cost-effective alternative.

Table 19. ABDR Annual and Adjusted Life-Cycle Costs

Cost Category	CLSS
1. Unit Personnel	
Composite Pay	$ 3,644,580
Acquisition & Skills Training	189,152
2. Unit Level Consumption	250,000
5. Indirect Support	2,620,905
Peacetime Annual Cost	**6,704,637**
Peacetime Life Cycle Cost	207,843,746
Expected Team Factor	0.8646
Adjusted Peacetime LCC	**$ 179,684,271**

Recommendations for the ABDR CONOPS

It is apparent that each alternative has pros and cons. The CLSSs provide a more responsive force for the theater commander. In addition, CLSSs are more accustomed to the military lifestyle, which includes the potential of experiencing combat conditions. The CLSS approach will alleviate the concerns of exposing civilian personnel to wartime conditions, in which civilians might be captured, injured, or killed. In addition, the CLSS personnel are continually training on ABDR techniques. This training is often accomplished under simulated wartime conditions, including performing composite and

fiber optic repairs while wearing full chemical protective gear. For that reason, the full-time CLSS approach can provide more combat-capable ABDR teams.

However, these benefits come at the expense of scarce budget resources, and the full-time employment of CLSSs provides the primary reason for receiving benefits through CLS. The CLS alternative will provide a slightly less combat-ready ABDR capability, but potentially at a lower cost. The CLSSs' high cost, combined with the consistent success with which DoD has used civilians in contingencies, makes the CLS option a viable solution to the ABDR ownership decision. Although the costs of some categories were not quantifiable, review of existing cost information leads to the likelihood that CLS will be less expensive. The CLS part-time, or standby approach, provides this cost difference. Because ABDR personnel in this alternative would not be full-time employed, the USAF would save considerable money from a reduced infrastructure. These savings could then be directed into modernization programs, thus helping improve the tooth-to-tail ratio. In addition, by using CLS, the USAF would not have to invest in a capability in which the contractor has a large portion in depot and assembly personnel. Furthermore, if the contractor's depot contained excess capacity, it would be advantageous to utilize that capacity. With some additional training for these individuals, a contractor could provide highly capable ABDR teams. As precedence and current DoD plans have proven, contractor personnel are also capable of performing the ABDR mission during wartime conditions. Considering these apparent trade-offs, the solution to the ABDR ownership decision may lie in a dual approach.

A dual approach would mean using organic forces as the rapid response team, capable of deploying on a moments notice. In addition, this organic team could be used to help sortie generation efforts on the ramp, just as they are expected to be used now. The contractor team would accomplish the heavy maintenance and highly technical repairs. It is possible that both the organic and contractor teams could serve in the same location; or, the contractor could be located farther toward the rear of the theater of operations. A dual approach to the ABDR ownership question would allow the decision-maker to reap the benefits of both alternatives while also minimizing the drawbacks of each. The USAF would then have an improved ABDR capability for reduced costs. Having a smaller organic force would help save budget resources, while still providing increased responsiveness and flexibility to the theater commander. In addition, existence of an organic component would reduce the uncertainty in ABDR capability. Having an augmenting CLS force would provide the theater commander with a pre-planned contractor-supported ABDR capability from day one of F-22 IOC.

Other potential benefits from a dual approach are:

- The organic force could provide the short-notice response capability, removing that requirement from the CLS force. As a result, CLS personnel readiness requirements could be reduced, thus lowering CLS ABDR contract costs. Also, in the time between organic and CLS deployments, the CLS forces could receive any training required for full readiness. This is much the same as what the CLSSs ended up doing during ODS/DS while they were waiting for transport to the Persian Gulf.

- Pre-planned use of a CLS component would likely reduce the ABDR costs incurred if and when we need to use contractor support during a contingency. One important reason for excessive contractor logistics support costs is spontaneous requirements; and it is very likely contractors will be called into action whether we include them in plans or not.

- Utilizing CLS to augment the CLSS forces would provide a redundancy; but, at a lower cost than only having a CLSS. As a result, the commander has more choices in the theater. This is precisely the reasoning behind the LOGCAP program.

- A dual approach would be an innovative way to provide both an effective and efficient ABDR capability. This combination is what congressional and executive leadership expect from the DoD. It is imperative that DoD decision-makers make both effectiveness and efficiency a priority, in order to provide a capable but lean tooth-to-tail ratio.

- Anything initiated for the F-22 program will provide beneficial lessons for the USAF when it begins acquiring the Joint Strike Fighter (JSF). Considering the fact that the JSF is slated to be a joint service aircraft, it is not unreasonable to assume that JSF ABDR will include a joint concept. Since the Navy and Army are already outsourcing combat-related functions, a dual F-22 ABDR approach would provide the USAF more experience which will help in joint operations.

- Using a dual approach would obviate the question of whether the ABDR function could be outsourced. By including an organic portion to the ABDR concept, the USAF could use some CLS for augmenting the CLSS and avoid any potential political or parochial problems.

Recommendation to Initiate an F-22 ABDR Integrated Product Team

In order to successfully coordinate an F-22 CONOPS, F-22 ABDR planners need to take advantage of a leading managerial practice: that is, they should initiate an IPT. Because IPTs have already proven their worth, the DoD has begun to rely heavily on them for nearly every major acquisition program. The F-22 ABDR function could also reap many benefits, as any program involving contractor personnel requires exceptional coordination and planning. Regardless of the alternative chosen for providing ABDR to F-22 warfighters, an ABDR IPT would be beneficial, and should include representation from the following entities as a minimum:

- F-22 Logistics Support Division
- AFMC/LGM
- ABDR Program Management Office
- F-22 System Program Office, Wright-Patterson AFB
- Air Combat Command
- USAF Legal
- USAF Contracting
- USAF Financial Management
- Army LOGCAP (facilitator role)

Recommendations For Future Research

Obtain Unavailable Cost Data For Improved Economic Analysis

In light of the fact that crucial data, information, and program decisions were unavailable for this study, future research efforts should focus on obtaining these items. Subsequently, more accurate quantitative assessments could be made for the *Depot Field Requirements, Contractor Logistics Support*, and *Administration and Planning* cost categories.

Once a more accurate estimate of the CLSS cost is obtained, the F-22 ABDR decision-maker could submit solicitations for rough order of magnitude (ROM) estimates. These ROMs are initial estimates from contractors which approximate how much a service will cost contractors to provide. They are non-binding estimates; however, they would provide an improved estimate for the CLS alternative.

Quantify Benefits of CLS and CLSS

Another research effort should focus on quantifying the *benefits* of using either organic versus contractor personnel. A potential research design could include surveying various experts of crucial parameters to discover respective weighted values for: deployability; readiness (physically, mentally, and technically ready); reliability (will the contractor personnel remain in the theater when the conditions worsen?); and ABDR effectiveness in hostile zones. Once crucial parameters are quantified, cost figures could be obtained and a more insightful economic analysis completed.

Summary

Designed with state-of-the-art technology, the F-22 Raptor is scheduled to replace the F-15 as the primary United States Air Force (USAF) air superiority fighter. With enhanced stealth capabilities, the Raptor will provide war-fighters with the most dominant air superiority vehicle in the world. However, an effective and efficient ABDR program is crucial for ensuring that the Raptor is able to sustain that dominance. The DoD budget is continually being reduced, and with the recent balanced budget agreement, Congress and the President have ensured us that future budget dollars will be even harder to come by (Clymer, 1997). This causes a dilemma for the appropriate ABDR decision-maker: Whether to use a CLS or CLSS approach to provide the most effective, yet efficient, ABDR capability. The solution to the dilemma is to use a dual approach, with both contractors and organic personnel structured into the ABDR support plans.

Appendix A: VAMOSC FY 95 F-16D Cost Report

FY	MDS	Cmd	TAI	POSS TAI	BAI	PAA	FH	CAIG Level 1	CAIG Level 2	CAIG Level 3	Cost
1995	F016D	AET	69	62	14	55	19,442	Mission Personnel	Operations(Aircrew)	Officer P/A	$5,003,174
1995	F016D	AET	69	62	14	55	19,442	Mission Personnel	Operations(Aircrew)	Airmen P/A	$5,721
1995	F016D	AET	69	62	14	55	19,442	Mission Personnel	Maintenance	Officer P/A	$882,424
1995	F016D	AET	69	62	14	55	19,442	Mission Personnel	Maintenance	Airmen P/A	$30,620,463
1995	F016D	AET	69	62	14	55	19,442	Mission Personnel	Maintenance	Civilian P/A	$0
1995	F016D	AET	69	62	14	55	19,442	Mission Personnel	Other Mission Personnel	Officer P/A	$1,408,005
1995	F016D	AET	69	62	14	55	19,442	Mission Personnel	Other Mission Personnel	Airmen P/A	$3,900,167
1995	F016D	AET	69	62	14	55	19,442	Mission Personnel	Other Mission Personnel	Civilian P/A	$94,914
1995	F016D	AET	69	62	14	55	19,442	Unit Level Consumption	Aviation POL	AVFuel	$11,755,938
1995	F016D	AET	69	62	14	55	19,442	Unit Level Consumption	Aviation POL	Other POL	$0
1995	F016D	AET	69	62	14	55	19,442	Unit Level Consumption	Consumable Supplies	General Support Division Supplies	$2,921,151
1995	F016D	AET	69	62	14	55	19,442	Unit Level Consumption	Consumable Supplies	System Support Division Supplies	$2,406,926
1995	F016D	AET	69	62	14	55	19,442	Unit Level Consumption	Consumable Supplies	Other Maintenance Material	$0
1995	F016D	AET	69	62	14	55	19,442	Unit Level Consumption	Consumable Supplies	Mission Support Supplies	$108,402
1995	F016D	AET	69	62	14	55	19,442	Unit Level Consumption	Depot Level Reparables		$23,788,361
1995	F016D	AET	69	62	14	55	19,442	Unit Level Consumption	Training Munitions		$3,188,488
1995	F016D	AET	69	62	14	55	19,442	Unit Level Consumption	Other Mission Support		$36,749
1995	F016D	AET	69	62	14	55	19,442	Depot Maintenance	Overhaul/Rework	Airframe Overhaul	$923,415
1995	F016D	AET	69	62	14	55	19,442	Depot Maintenance	Overhaul/Rework	Engine Overhaul	$1,427,732
1995	F016D	AET	69	62	14	55	19,442	Depot Maintenance	Overhaul/Rework	Support Equipment	$150,201
1995	F016D	AET	69	62	14	55	19,442	Depot Maintenance	Other		$7,704,385
1995	F016D	AET	69	62	14	55	19,442	Contractor Support	Interim Contractor Support		$728,112
1995	F016D	AET	69	62	14	55	19,442	Contractor Support	Contractor Logistics Support		$0
1995	F016D	AET	69	62	14	55	19,442	Contractor Support	Other		$61,394
1995	F016D	AET	69	62	14	55	19,442	Sustaining Support	Replacement Support Equipment		$2,193,620
1995	F016D	AET	69	62	14	55	19,442	Sustaining Support	Mod Kit Procurement/Installation		$2,020,030
1995	F016D	AET	69	62	14	55	19,442	Sustaining Support	Other Recurring Investment		$0
1995	F016D	AET	69	62	14	55	19,442	Sustaining Support	Sustaining Engineering		$267,467
1995	F016D	AET	69	62	14	55	19,442	Sustaining Support	Software Maintenance		$774,907
1995	F016D	AET	69	62	14	55	19,442	Indirect Support	Personnel Support	Medical	$7,539,137
1995	F016D	AET	69	62	14	55	19,442	Indirect Support	Personnel Support	Training	$10,360,665
1995	F016D	AET	69	62	14	55	19,442	Indirect Support	Personnel Support	Officer PCS	$267,324
1995	F016D	AET	69	62	14	55	19,442	Indirect Support	Personnel Support	Airmen PCS	$732,312
1995	F016D	AET	69	62	14	55	19,442	Indirect Support	Personnel Support	Civilian PCS	$6,927
1995	F016D	AET	69	62	14	55	19,442	Indirect Support	Installation Support	BOS (Officer P/A)	$819,246
1995	F016D	AET	69	62	14	55	19,442	Indirect Support	Installation Support	BOS (Airmen P/A)	$5,479,568
1995	F016D	AET	69	62	14	55	19,442	Indirect Support	Installation Support	BOS (Civilian P/A)	$2,348,277
1995	F016D	AET	69	62	14	55	19,442	Indirect Support	Installation Support	RPM (Officer P/A)	$1,191,063
1995	F016D	AET	69	62	14	55	19,442	Indirect Support	Installation Support	RPM (Airmen P/A)	$1,419,348
1995	F016D	AET	69	62	14	55	19,442	Indirect Support	Installation Support	RPM (Civilian P/A)	$1,642,467
1995	F016D	AET	69	62	14	55	19,442	Indirect Support	Installation Support	IS (Non-Pay)	$10,879,093
1995	F016D	AFE	11	11	7	4	3,277	Mission Personnel	Operations(Aircrew)	Officer P/A	$945,133
1995	F016D	AFE	11	11	7	4	3,277	Mission Personnel	Operations(Aircrew)	Airmen P/A	$0
1995	F016D	AFE	11	11	7	4	3,277	Mission Personnel	Maintenance	Officer P/A	$417,395
1995	F016D	AFE	11	11	7	4	3,277	Mission Personnel	Maintenance	Airmen P/A	$9,549,185
1995	F016D	AFE	11	11	7	4	3,277	Mission Personnel	Maintenance	Civilian P/A	$88,130
1995	F016D	AFE	11	11	7	4	3,277	Mission Personnel	Other Mission Personnel	Officer P/A	$827,879
1995	F016D	AFE	11	11	7	4	3,277	Mission Personnel	Other Mission Personnel	Airmen P/A	$2,063,603
1995	F016D	AFE	11	11	7	4	3,277	Mission Personnel	Other Mission Personnel	Civilian P/A	$76,024

1995	F016D	AFE	11	11	7	4	3,277	Unit Level Consumption	Aviation POL	AVFuel	$1,997,942
1995	F016D	AFE	11	11	7	4	3,277	Unit Level Consumption	Aviation POL	Other POL	$57,271
1995	F016D	AFE	11	11	7	4	3,277	Unit Level Consumption	Consumable Supplies	General Support Division Supplies	$695,628
1995	F016D	AFE	11	11	7	4	3,277	Unit Level Consumption	Consumable Supplies	System Support Division Supplies	$371,800
1995	F016D	AFE	11	11	7	4	3,277	Unit Level Consumption	Consumable Supplies	Other Maintenance Material	$288,023
1995	F016D	AFE	11	11	7	4	3,277	Unit Level Consumption	Consumable Supplies	Mission Support Supplies	$252,968
1995	F016D	AFE	11	11	7	4	3,277	Unit Level Consumption	Depot Level Reparables		$3,335,457
1995	F016D	AFE	11	11	7	4	3,277	Unit Level Consumption	Training Munitions		$537,428
1995	F016D	AFE	11	11	7	4	3,277	Unit Level Consumption	Other Mission Support		$962,298
1995	F016D	AFE	11	11	7	4	3,277	Depot Maintenance	Overhaul/Rework	Airframe Overhaul	$156,097
1995	F016D	AFE	11	11	7	4	3,277	Depot Maintenance	Overhaul/Rework	Engine Overhaul	$239,300
1995	F016D	AFE	11	11	7	4	3,277	Depot Maintenance	Overhaul/Rework	Support Equipment	$25,390
1995	F016D	AFE	11	11	7	4	3,277	Depot Maintenance	Other		$1,300,424
1995	F016D	AFE	11	11	7	4	3,277	Contractor Support	Interim Contractor Support		$116,076
1995	F016D	AFE	11	11	7	4	3,277	Contractor Support	Contractor Logistics Support		$0
1995	F016D	AFE	11	11	7	4	3,277	Contractor Support	Other		$81,387
1995	F016D	AFE	11	11	7	4	3,277	Sustaining Support	Replacement Support Equipment		$159,536
1995	F016D	AFE	11	11	7	4	3,277	Sustaining Support	Mod Kit Procurement/Installation		$341,471
1995	F016D	AFE	11	11	7	4	3,277	Sustaining Support	Other Recurring Investment		$0
1995	F016D	AFE	11	11	7	4	3,277	Sustaining Support	Sustaining Engineering		$480,855
1995	F016D	AFE	11	11	7	4	3,277	Sustaining Support	Software Maintenance		$774,830
1995	F016D	AFE	11	11	7	4	3,277	Indirect Support	Personnel Support	Medical	$2,500,112
1995	F016D	AFE	11	11	7	4	3,277	Indirect Support	Personnel Support	Training	$3,268,195
1995	F016D	AFE	11	11	7	4	3,277	Indirect Support	Personnel Support	Officer PCS	$95,695
1995	F016D	AFE	11	11	7	4	3,277	Indirect Support	Personnel Support	Airmen PCS	$278,573
1995	F016D	AFE	11	11	7	4	3,277	Indirect Support	Personnel Support	Civilian PCS	$507
1995	F016D	AFE	11	11	7	4	3,277	Indirect Support	Installation Support	BOS (Officer P/A)	$449,530
1995	F016D	AFE	11	11	7	4	3,277	Indirect Support	Installation Support	BOS (Airmen P/A)	$3,139,173
1995	F016D	AFE	11	11	7	4	3,277	Indirect Support	Installation Support	BOS (Civilian P/A)	$955,191
1995	F016D	AFE	11	11	7	4	3,277	Indirect Support	Installation Support	RPM (Officer P/A)	$71,914
1995	F016D	AFE	11	11	7	4	3,277	Indirect Support	Installation Support	RPM (Airmen P/A)	$669,957
1995	F016D	AFE	11	11	7	4	3,277	Indirect Support	Installation Support	RPM (Civilian P/A)	$344,703
1995	F016D	AFE	11	11	7	4	3,277	Indirect Support	Installation Support	IS (Non-Pay)	$7,352,493
1995	F016D	CMB	48	38	23	25	9,506	Mission Personnel	Operations(Aircrew)	Officer P/A	$3,656,617
1995	F016D	CMB	48	38	23	25	9,506	Mission Personnel	Operations(Aircrew)	Airmen P/A	$67,289
1995	F016D	CMB	48	38	23	25	9,506	Mission Personnel	Maintenance	Officer P/A	$1,041,840
1995	F016D	CMB	48	38	23	25	9,506	Mission Personnel	Maintenance	Airmen P/A	$28,351,272
1995	F016D	CMB	48	38	23	25	9,506	Mission Personnel	Maintenance	Civilian P/A	$268,576
1995	F016D	CMB	48	38	23	25	9,506	Mission Personnel	Other Mission Personnel	Officer P/A	$3,991,240
1995	F016D	CMB	48	38	23	25	9,506	Mission Personnel	Other Mission Personnel	Airmen P/A	$8,111,825
1995	F016D	CMB	48	38	23	25	9,506	Mission Personnel	Other Mission Personnel	Civilian P/A	$548,402
1995	F016D	CMB	48	38	23	25	9,506	Unit Level Consumption	Aviation POL	AVFuel	$7,057,289
1995	F016D	CMB	48	38	23	25	9,506	Unit Level Consumption	Aviation POL	Other POL	$102,278
1995	F016D	CMB	48	38	23	25	9,506	Unit Level Consumption	Consumable Supplies	General Support Division Supplies	$1,663,252
1995	F016D	CMB	48	38	23	25	9,506	Unit Level Consumption	Consumable Supplies	System Support Division Supplies	$938,655
1995	F016D	CMB	48	38	23	25	9,506	Unit Level Consumption	Consumable Supplies	Other Maintenance Material	$413,638
1995	F016D	CMB	48	38	23	25	9,506	Unit Level Consumption	Consumable Supplies	Mission Support Supplies	$858,472
1995	F016D	CMB	48	38	23	25	9,506	Unit Level Consumption	Depot Level Reparables		$11,770,879
1995	F016D	CMB	48	38	23	25	9,506	Unit Level Consumption	Training Munitions		$1,558,984
1995	F016D	CMB	48	38	23	25	9,506	Unit Level Consumption	Other Mission Support		$681,001

(Appendix A continued)

1995	F016D	CMB	48	38	23	25	9,506	Depot Maintenance	Overhaul/Rework	Airframe Overhaul	$560,443
1995	F016D	CMB	48	38	23	25	9,506	Depot Maintenance	Overhaul/Rework	Engine Overhaul	$696,389
1995	F016D	CMB	48	38	23	25	9,506	Depot Maintenance	Overhaul/Rework	Support Equipment	$91,161
1995	F016D	CMB	48	38	23	25	9,506	Depot Maintenance	Other		$4,649,573
1995	F016D	CMB	48	38	23	25	9,506	Contractor Support	Interim Contractor Support		$506,512
1995	F016D	CMB	48	38	23	25	9,506	Contractor Support	Contractor Logistics Support		$1,150,035
1995	F016D	CMB	48	38	23	25	9,506	Contractor Support	Other		$2,961,876
1995	F016D	CMB	48	38	23	25	9,506	Sustaining Support	Replacement Support Equipment		$997,100
1995	F016D	CMB	48	38	23	25	9,506	Sustaining Support	Mod Kit Procurement/Installation		$1,226,006
1995	F016D	CMB	48	38	23	25	9,506	Sustaining Support	Other Recurring Investment		$0
1995	F016D	CMB	48	38	23	25	9,506	Sustaining Support	Sustaining Engineering		$1,373,900
1995	F016D	CMB	48	38	23	25	9,506	Sustaining Support	Software Maintenance		$2,259,968
1995	F016D	CMB	48	38	23	25	9,506	Indirect Support	Personnel Support	Medical	$8,051,498
1995	F016D	CMB	48	38	23	25	9,506	Indirect Support	Personnel Support	Training	$10,705,846
1995	F016D	CMB	48	38	23	25	9,506	Indirect Support	Personnel Support	Officer PCS	$265,487
1995	F016D	CMB	48	38	23	25	9,506	Indirect Support	Personnel Support	Airmen PCS	$983,190
1995	F016D	CMB	48	38	23	25	9,506	Indirect Support	Personnel Support	Civilian PCS	$3,981
1995	F016D	CMB	48	38	23	25	9,506	Indirect Support	Installation Support	BOS (Officer P/A)	$955,462
1995	F016D	CMB	48	38	23	25	9,506	Indirect Support	Installation Support	BOS (Airmen P/A)	$6,544,853
1995	F016D	CMB	48	38	23	25	9,506	Indirect Support	Installation Support	BOS (Civilian P/A)	$2,371,368
1995	F016D	CMB	48	38	23	25	9,506	Indirect Support	Installation Support	RPM (Officer P/A)	$188,406
1995	F016D	CMB	48	38	23	25	9,506	Indirect Support	Installation Support	RPM (Airmen P/A)	$1,512,339
1995	F016D	CMB	48	38	23	25	9,506	Indirect Support	Installation Support	RPM (Civilian P/A)	$2,018,287
1995	F016D	CMB	48	38	23	25	9,506	Indirect Support	Installation Support	IS (Non-Pay)	$12,061,076
1995	F016D	PAF	16	16	8	8	4,434	Mission Personnel	Operations(Aircrew)	Officer P/A	$1,473,332
1995	F016D	PAF	16	16	8	8	4,434	Mission Personnel	Operations(Aircrew)	Airmen P/A	$0
1995	F016D	PAF	16	16	8	8	4,434	Mission Personnel	Maintenance	Officer P/A	$374,400
1995	F016D	PAF	16	16	8	8	4,434	Mission Personnel	Maintenance	Airmen P/A	$12,076,805
1995	F016D	PAF	16	16	8	8	4,434	Mission Personnel	Maintenance	Civilian P/A	$119,620
1995	F016D	PAF	16	16	8	8	4,434	Mission Personnel	Other Mission Personnel	Officer P/A	$1,888,560
1995	F016D	PAF	16	16	8	8	4,434	Mission Personnel	Other Mission Personnel	Airmen P/A	$4,583,238
1995	F016D	PAF	16	16	8	8	4,434	Mission Personnel	Other Mission Personnel	Civilian P/A	$87,591
1995	F016D	PAF	16	16	8	8	4,434	Unit Level Consumption	Aviation POL	AVFuel	$2,936,850
1995	F016D	PAF	16	16	8	8	4,434	Unit Level Consumption	Aviation POL	Other POL	$109,447
1995	F016D	PAF	16	16	8	8	4,434	Unit Level Consumption	Consumable Supplies	General Support Division Supplies	$800,735
1995	F016D	PAF	16	16	8	8	4,434	Unit Level Consumption	Consumable Supplies	System Support Division Supplies	$568,065
1995	F016D	PAF	16	16	8	8	4,434	Unit Level Consumption	Consumable Supplies	Other Maintenance Material	$471,195
1995	F016D	PAF	16	16	8	8	4,434	Unit Level Consumption	Consumable Supplies	Mission Support Supplies	$597,079
1995	F016D	PAF	16	16	8	8	4,434	Unit Level Consumption	Depot Level Reparables		$5,735,090
1995	F016D	PAF	16	16	8	8	4,434	Unit Level Consumption	Training Munitions		$727,176
1995	F016D	PAF	16	16	8	8	4,434	Unit Level Consumption	Other Mission Support		$187,255
1995	F016D	PAF	16	16	8	8	4,434	Depot Maintenance	Overhaul/Rework	Airframe Overhaul	$240,727
1995	F016D	PAF	16	16	8	8	4,434	Depot Maintenance	Overhaul/Rework	Engine Overhaul	$325,340
1995	F016D	PAF	16	16	8	8	4,434	Depot Maintenance	Overhaul/Rework	Support Equipment	$39,156
1995	F016D	PAF	16	16	8	8	4,434	Depot Maintenance	Other		$2,001,155
1995	F016D	PAF	16	16	8	8	4,434	Contractor Support	Interim Contractor Support		$168,837
1995	F016D	PAF	16	16	8	8	4,434	Contractor Support	Contractor Logistics Support		$0
1995	F016D	PAF	16	16	8	8	4,434	Contractor Support	Other		$131,317
1995	F016D	PAF	16	16	8	8	4,434	Sustaining Support	Replacement Support Equipment		$319,072
1995	F016D	PAF	16	16	8	8	4,434	Sustaining Support	Mod Kit Procurement/Installation		$526,607

(Appendix A continued)

(Appendix A continued)

1995	F016D	PAF	16	16	8	8	4,434	Sustaining Support	Other Recurring Investment		$0
1995	F016D	PAF	16	16	8	8	4,434	Sustaining Support	Sustaining Engineering		$751,435
1995	F016D	PAF	16	16	8	8	4,434	Sustaining Support	Software Maintenance		$1,209,277
1995	F016D	PAF	16	16	8	8	4,434	Indirect Support	Personnel Support	Medical	$3,659,349
1995	F016D	PAF	16	16	8	8	4,434	Indirect Support	Personnel Support	Training	$4,819,906
1995	F016D	PAF	16	16	8	8	4,434	Indirect Support	Personnel Support	Officer PCS	$340,459
1995	F016D	PAF	16	16	8	8	4,434	Indirect Support	Personnel Support	Airmen PCS	$1,882,920
1995	F016D	PAF	16	16	8	8	4,434	Indirect Support	Personnel Support	Civilian PCS	$557
1995	F016D	PAF	16	16	8	8	4,434	Indirect Support	Installation Support	BOS (Officer P/A)	$713,388
1995	F016D	PAF	16	16	8	8	4,434	Indirect Support	Installation Support	BOS (Airmen P/A)	$5,238,371
1995	F016D	PAF	16	16	8	8	4,434	Indirect Support	Installation Support	BOS (Civilian P/A)	$1,119,069
1995	F016D	PAF	16	16	8	8	4,434	Indirect Support	Installation Support	RPM (Officer P/A)	$142,567
1995	F016D	PAF	16	16	8	8	4,434	Indirect Support	Installation Support	RPM (Airmen P/A)	$1,089,836
1995	F016D	PAF	16	16	8	8	4,434	Indirect Support	Installation Support	RPM (Civilian P/A)	$755,423
1995	F016D	PAF	16	16	8	8	4,434	Indirect Support	Installation Support	IS (Non-Pay)	$10,069,631

Appendix B: Incremental Costs of Deployed CLS vs. CLSS

WCF	PAW	0	5	10	15	20
(cls - clss)/clss	CLSS Cost	$ 0	$ 5,025,523	$ 10,051,046	$ 15,076,569	$ 20,102,092
0		0	0	0	0	0
0.1		0	502,552	1,005,105	1,507,657	2,010,209
0.2		0	1,005,105	2,010,209	3,015,314	4,020,418
0.3		0	1,507,657	3,015,314	4,522,971	6,030,628
0.4		0	2,010,209	4,020,418	6,030,628	8,040,837
0.5		0	2,512,762	5,025,523	7,538,285	10,051,046
1		0	5,025,523	10,051,046	15,076,569	20,102,092
1.5		0	7,538,285	15,076,569	22,614,854	30,153,139
2		0	10,051,046	20,102,092	30,153,139	40,204,185
2.5		0	12,563,808	25,127,616	37,691,423	50,255,231
3		0	15,076,569	30,153,139	45,229,708	60,306,277
3.5		0	17,589,331	35,178,662	52,767,993	70,357,324
4		0	20,102,092	40,204,185	60,306,277	80,408,370
5		0	25,127,616	50,255,231	75,382,847	100,510,462
10		0	50,255,231	100,510,462	150,765,694	201,020,925

WCF	25	30	35	40	45	50
	$ 25,127,616	$ 30,153,139	$ 35,178,662	$ 40,204,185	$ 45,229,708	$ 50,255,231
0	0	0	0	0	0	0
0.1	2,512,762	3,015,314	3,517,866	4,020,418	4,522,971	5,025,523
0.2	5,025,523	6,030,628	7,035,732	8,040,837	9,045,942	10,051,046
0.3	7,538,285	9,045,942	10,553,599	12,061,255	13,568,912	15,076,569
0.4	10,051,046	12,061,255	14,071,465	16,081,674	18,091,883	20,102,092
0.5	12,563,808	15,076,569	17,589,331	20,102,092	22,614,854	25,127,616
1	25,127,616	30,153,139	35,178,662	40,204,185	45,229,708	50,255,231
1.5	37,691,423	45,229,708	52,767,993	60,306,277	67,844,562	75,382,847
2	50,255,231	60,306,277	70,357,324	80,408,370	90,459,416	100,510,462
2.5	62,819,039	75,382,847	87,946,655	100,510,462	113,074,270	125,638,078
3	75,382,847	90,459,416	105,535,985	120,612,555	135,689,124	150,765,694
3.5	87,946,655	105,535,985	123,125,316	140,714,647	158,303,978	175,893,309
4	100,510,462	120,612,555	140,714,647	160,816,740	180,918,832	201,020,925
5	125,638,078	150,765,694	175,893,309	201,020,925	226,148,540	251,276,156
10	251,276,156	301,531,387	351,786,618	402,041,849	452,297,081	502,552,312

Appendix C: F-22 LCC Sensitivity Using War Factors of 2, 3, and 4

Varying Cases	CLSS Cost Annual	CLSS Cost LCC	Marg. CLS War LCC	Δ
WCF - 2				
Base Case	**$ 6,704,637**	**$ 179,684,271**	**$ 40,204,185**	**$ 139,480,086**
1. #/Team - 11	4,688,755	125,658,639	27,634,214	98,024,426
2. IS/MP (.55)	6,088,251	163,165,127	40,204,185	122,960,942
3. IS/MP (.86)	7,218,071	193,444,303	40,204,185	153,240,118
4. Expect. Teams (3)	6,704,637	124,706,248	27,902,905	96,803,344
5. Expect. Teams (5)	6,704,637	207,843,747	46,504,841	161,338,906
5. 1 & 2	4,265,084	114,304,260	27,634,214	86,670,047
6. 1 & 3	5,041,662	135,116,547	27,634,214	107,482,334
7. 1 & 4	4,688,755	87,210,846	19,178,969	68,031,877
8. 1 & 5	4,688,755	145,351,405	31,964,949	113,386,457
9. 2 & 4	6,088,251	113,241,468	27,902,905	85,338,564
10. 2 & 5	6,088,251	188,735,780	46,504,841	142,230,939
11. 3 & 4	7,218,071	134,256,117	27,902,905	106,353,213
12. 3 & 5	7,218,071	223,760,194	46,504,841	177,255,353
13. 1,2,& 4	4,265,084	79,330,568	19,178,969	60,151,599
WCF - 3				
Base Case	**$ 6,704,637**	**$ 179,684,271**	**$ 60,306,278**	**$ 119,377,994**
1. #/Team - 11	4,688,755	125,658,639	41,451,320	84,207,319
2. IS/MP (.55)	6,088,251	163,165,127	60,306,278	102,858,849
3. IS/MP (.86)	7,218,071	193,444,303	60,306,278	133,138,026
4. Expect. Teams (3)	6,704,637	124,706,248	41,854,357	82,851,891
5. Expect. Teams (5)	6,704,637	207,843,747	69,757,262	138,086,486
5. 1 & 2	4,265,084	114,304,260	41,451,320	72,852,940
6. 1 & 3	5,041,662	135,116,547	41,451,320	93,665,227
7. 1 & 4	4,688,755	87,210,846	28,768,454	58,442,393
8. 1 & 5	4,688,755	145,351,405	47,947,423	97,403,982
9. 2 & 4	6,088,251	113,241,468	41,854,357	71,387,111
10. 2 & 5	6,088,251	188,735,780	69,757,262	118,978,519
11. 3 & 4	7,218,071	134,256,117	41,854,357	92,401,760
12. 3 & 5	7,218,071	223,760,194	69,757,262	154,002,933
13. 1,2,& 4	4,265,084	79,330,568	28,768,454	50,562,115

(Appendix C continued)

Varying Cases	CLSS Cost Annual	CLSS Cost LCC	Marg. CLS War LCC	Δ
WCF - 4				
Base Case	**$ 6,704,637**	**$ 179,684,271**	**$ 80,408,370**	**$ 99,275,901**
1. #/Team - 11	4,688,755	125,658,639	55,268,427	70,390,212
2. IS/MP (.55)	6,088,251	163,165,127	80,408,370	82,756,757
3. IS/MP (.86)	7,218,071	193,444,303	80,408,370	113,035,933
4. Expect. Teams (3)	6,704,637	124,706,248	55,805,809	68,900,439
5. Expect. Teams (5)	6,704,637	207,843,747	93,009,682	114,834,065
5. 1 & 2	4,265,084	114,304,260	55,268,427	59,035,833
6. 1 & 3	5,041,662	135,116,547	55,268,427	79,848,120
7. 1 & 4	4,688,755	87,210,846	38,357,938	48,852,908
8. 1 & 5	4,688,755	145,351,405	63,929,897	81,421,508
9. 2 & 4	6,088,251	113,241,468	55,805,809	57,435,659
10. 2 & 5	6,088,251	188,735,780	93,009,682	95,726,098
11. 3 & 4	7,218,071	134,256,117	55,805,809	78,450,308
12. 3 & 5	7,218,071	223,760,194	93,009,682	130,750,512
13. 1,2,& 4	4,265,084	79,330,568	38,357,938	40,972,630

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Capt John A. Kitchens [redacted] graduated from Burkburnett High School in 1983, and enlisted in the United States Army in 1984 as a combat engineer. Once his three year enlistment was complete in 1987, he entered undergraduate studies at Texas A&M University in College Station, Texas. While earning his degree, he spent one year as a student engineer with American Airlines at their Maintenance and Engineering Base. He graduated with a Bachelor of Science Degree in Aerospace Engineering in May 1992, and received his commission on 26 May 1993 upon graduation from Officer Training School.

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13. ABSTRACT ***(Maximum 200 Words)***

The purpose of this study was to evaluate whether Contractor Logistics Support (CLS) is a viable alternative to Combat Logistics Support Squadrons (CLSSs) for providing F-22 Aircraft Battle Damage Repair (ABDR). Legalities, practicalities, and cost-effectiveness were key ownership concerns. United States Code, Office of Management and Budget, Department of Defense (DoD), and United States Air Force (USAF) requirements were reviewed to address legal and policy issues and whether F-22 ABDR is military essential. The Army's Logistics Civil Augmentation Program (LOGCAP) award fee history was used to assess the potential performance of F-22 ABDR CLS personnel. F-117 ABDR team requirements and costs were used to estimate F-22 CLSS costs. Results show DoD must decide if F-22 ABDR is a core logistics function and the USAF must determine F-22 ABDR requirements before outsourcing legality is clear. However, DoD civilian reliance continues today, and LOGCAP experiences attest that contractors consistently meet or exceed all clearly stated requirements. Analysis found that CLSS will provide higher combat readiness; although, CLS may provide slightly less combat readiness, but for potentially less cost. A dual approach, using a mixture of CLSS and CLS, could provide the most effective capability in terms of both combat readiness and cost.

14. Subject Terms

Aircraft Battle Damage Repair (ABDR), Cost Estimating, Contractor Logistics Support (CLS), Civilian, Outsourcing, Economic Analysis, US Code, Policy, Contingency Operations, Manning Criteria, Logistics Civil Augmentation Program (LOGCAP), Readiness, Military Essential, Inherently Governmental Function

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