# COST, CAPABILITY, AND THE HUNT FOR A LIGHTWEIGHT GROUND ATTACK AIRCRAFT

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE
General Studies

by

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Fort Leavenworth, Kansas
2009

# REPORT DOCUMENTATION PAGE

*Form Approved*
*OMB No. 0704-0188*



| **1. REPORT DATE** *(DD-MM-YYYY)* | **2. REPORT TYPE** | **3. DATES COVERED** *(From - To)* |
|---|---|---|
| 12-06-2009 | Master's Thesis | AUG 2008 – JUN 2009 |

**4. TITLE AND SUBTITLE**
Cost, Capability, and the Hunt for a Lightweight Ground Attack Aircraft

**5a. CONTRACT NUMBER**

**5b. GRANT NUMBER**

**5c. PROGRAM ELEMENT NUMBER**

**6. AUTHOR(S)**
Maj. Steven J. Tittel, USAF

**5d. PROJECT NUMBER**

**5e. TASK NUMBER**

**5f. WORK UNIT NUMBER**

**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**
U.S. Army Command and General Staff College
ATTN: ATZL-SWD-GD
Fort Leavenworth, KS 66027-2301

**8. PERFORMING ORG REPORT NUMBER**

**9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)**

**10. SPONSOR/MONITOR'S ACRONYM(S)**

**11. SPONSOR/MONITOR'S REPORT NUMBER(S)**

**12. DISTRIBUTION / AVAILABILITY STATEMENT**
Approved for Public Release; Distribution is Unlimited

**13. SUPPLEMENTARY NOTES**

**14. ABSTRACT**

Since 2001, U.S. Air Force fighter aircraft have flown combat sorties with abnormally high flight durations while participating in Operations Iraqi Freedom and Enduring Freedom. These longer sortie durations have added previously unanticipated flight time to aging airframes thereby reducing the expected service life of the U.S. Air Force's legacy fighter fleet. This study examines the costs and benefits of fielding a propeller driven lightweight ground attack aircraft to support air operations in counter insurgency and stability operations. Fielding a lightweight ground attack aircraft could enable the U.S. Air Force to redeploy the bulk of its legacy fighter fleet to home stations and resume non-contingency operations. This would effectively reduce annual flight times and thereby extend expected service life. This study will use a document review to determine the expected economic impact, combat capability, survivability, and potential roles and missions relative to fielding a lightweight ground attack aircraft.

**15. SUBJECT TERMS**
Lightweight ground attack aircraft, CAS, COIN, JTAC, legacy fighter, AT-6B, transformation

| **16. SECURITY CLASSIFICATION OF: Unclassified** | | | **17. LIMITATION OF ABSTRACT** | **18. NUMBER OF PAGES** | **19a. NAME OF RESPONSIBLE PERSON** |
|---|---|---|---|---|---|
| **a. REPORT** | **b. ABSTRACT** | **c. THIS PAGE** | | | **19b. PHONE NUMBER** *(include area code)* |
| (U) | (U) | (U) | (U) | 89 | |

**Standard Form 298 (Rev. 8-98)**
**Prescribed by ANSI Std. Z39.18**

MASTER OF MILITARY ART AND SCIENCE
THESIS APPROVAL PAGE

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

COST, CAPABILITY, AND THE HUNT FOR A LIGHTWEIGHT GROUND ATTACK AIRCRAFT, by Major Steven J. Tittel, 89 pages.

Since 2001, U.S. Air Force fighter aircraft have flown combat sorties with abnormally high flight durations while participating in Operations Iraqi Freedom and Enduring Freedom. These longer sortie durations have added previously unanticipated flight time to aging airframes thereby reducing the expected service life of the U.S. Air Force's legacy fighter fleet. This study examines the costs and benefits of fielding a propeller driven lightweight ground attack aircraft to support air operations in counter insurgency and stability operations. Fielding a lightweight ground attack aircraft could enable the U.S. Air Force to redeploy the bulk of its legacy fighter fleet to home stations and resume non-contingency operations. This would effectively reduce annual flight times and thereby extend expected service life. This study will use a document review to determine the expected economic impact, combat capability, survivability, and potential roles and missions relative to fielding a lightweight ground attack aircraft.

ACKNOWLEDGMENTS

I would like to thank the members of my committee for their assistance and guidance in developing this thesis. Colonel (Ret.) Daniel Jordan of the

Department of Joint Interagency and Multinational Operations provided timely, continuous, and constructive feedback, and kept me on course. Dr. Yvonne Doll of the Department of Command and Leadership offered her academic and analytical skills. Colonel (Ret.) David Neuenswander of the LeMay Center for Doctrine Development and Education aided me in my research and helped me formulate the problem in order to frame my conclusions and recommendations. All three instructors dedicated their personal time and energy to my research efforts. Their personal attention was invaluable in developing this thesis. However, any errors of fact or logic are the author‘s sole responsibility.

I especially want to thank my family for supporting me during the academic year. To my children, John and Anna, thank you for helping me keep things in perspective. To my wife, Jennifer, thank you for your devotion and steadfast support to both our family and country.

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ACRONYMS

| | |
|---|---|
| AAA | Anti-aircraft Artillery |
| ACC | Air Combat Command |
| AFDD | Air Force Doctrine Document |
| AEF | Aerospace Expeditionary Force |
| AETACS | Airborne Element of Theater Air Control System |
| AFOTTP | Air Force Operational Tactics, Techniques, and Procedures |
| AFTTP | Air Force Tactics, Techniques, and Procedures |
| ANG | Air National Guard |
| AOC | Air Operations Center |
| AOR | Area of Responsibility |
| ATO | Air Tasking Order |
| AWACS | Airborne Warning and Control System |
| BLOS | Beyond Line of Sight |
| C2 | Command and Control |
| C2ISR | Command Control, Intelligence, Surveillance, and Reconnaissance |
| CAF | Combat Air Forces |
| CAS | Close Air Support |
| C/JFACC | Combined/Joint Forces Air Component Commander |
| COIN | Counterinsurgency |
| COTS | Commercial Off the Shelf |
| CSAR | Combat Search and Rescue |
| CT | Counter Terrorism |
| DOC | Designed Operational Capability |

| | |
|---|---|
| DT | Dynamic Targeting |
| FAC(A) | Forward Air Controller  Airborne |
| FTU | Flying Training Unit |
| IFF | Interrogator Friend or Foe |
| IFR | Instrument Flight Rules |
| ISR | Intelligence Surveillance and Reconnaissance |
| JP | Joint Publication |
| JTAC | Joint Terminal Attack Controller |
| JSF | Joint Strike Fighter |
| MANPADS | Man-portable Air Defense System |
| MDS | Major Design Series |
| MSL | Mean Sea Level |
| OEF | Operation Enduring freedom |
| OIF | Operation Iraqi Freedom |
| PDS | Passive Detection System |
| PR | Personnel Recovery |
| RFI | Request for Information |
| SATCOM | Satellite Communications |
| TACP | Tactical Air Control Party |
| TACS | Theater Air Control System |
| TTP | Tactics, Techniques, and Procedures |
| UAV | Unmanned Aerial Vehicle |
| UJTL | Universal Joint Task List |

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# CHAPTER 1

# INTRODUCTION

This study examines the costs and benefits of fielding a propeller driven lightweight ground attack aircraft to support air operations in counter insurgency and stability operations. Since 2001, U.S. Air Force legacy fighter aircraft including the F-16 C/D, F-15E, and A-10 have been called upon to fly combat sorties far exceeding standard peacetime durations during multiple combat deployments to Afghanistan and Iraq while participating in Operations Iraqi Freedom (OIF) and Enduring Freedom (OEF). These longer sortie durations added significant flight time to aging airframes, thereby reducing the expected service life of the U.S. Air Force‘s (USAF) legacy fighter fleet. Support aircraft including the KC-135 and KC-10 also flew far more hours than originally planned in support of these combat operations. In order to preserve a rapidly aging fighter and aerial tanker fleet, the USAF must provide effective close air support (CAS) and intelligence, surveillance, and reconnaissance (ISR) support to ground forces while simultaneously lowering flight time and operating and support (O&S) costs for legacy fighters and associated support aircraft. One possible solution is fielding a propeller driven lightweight ground attack aircraft.

The following chapter introduces the problem by presenting a brief background, statements of both the primary and secondary research questions, lists of assumptions, definitions, and limitations, and finally a summary of the thesis‘ significance.

## Background

Military forces used propeller driven aircraft to support ground troops even before the airplane made its first major appearance in battle during Word War I. In 1911, Italy became the first nation to use the airplane in combat during an attack on Turkish troops.[1] By the time World War I began, improvements in aviation technology led to a dramatic increase in the airplane's use against enemy ground forces. Because of differences in methods used for employing aviation assets by the warring nations, contentious issues began to emerge centering on CAS and CAS aircraft.

In his book *The Warthog and the Close Air Support Debate,* Douglas Campbell described how the Army Air Corps of the 1930s opted to buy ground attack aircraft sharing many characteristics with the finest fighters of the day in order to overcome increasingly lethal battlefield anti-aircraft defenses. As enemy air defenses continued to evolve throughout the middle of the 20th century, the now independent United States Air Force purchased jet propelled aircraft for the close air support role in order to achieve increased survivability. However, the purchase of jet aircraft failed to negate the value of propeller driven aircraft. Airplanes like the F-51 Mustang, B-26 Marauder, and A-1 Skyraider continued to provide valuable service as close air support platforms in conflicts including Korea and Vietnam. With the introduction of the A-10 Thunderbolt II however, the propeller driven aircraft's place in the U.S Air Force's stable seemed to be lost to the pages of history.

Since the beginning of major combat operations in OIF and OEF, U.S. Air Force fighters have patrolled the skies over Iraq and Afghanistan providing close air support to ground forces engaged in counter insurgency (COIN) operations. In addition to their

more lethal duties, legacy fighter aircraft are also tasked to provide real time intelligence surveillance and reconnaissance. These aircraft often loiter for long periods while only occasionally employing ordnance in support of ground operations. In order to avoid neighboring aircraft, during COIN operations, legacy aircraft often operate in small parcels of airspace that turn performance advantages into a liability. Airspace and altitude restrictions often hinder the pilot‘s ability to utilize standard medium altitude tactics and delivery options. The legacy fighter‘s speed, turn radius, and operating cost have proven a poor fit for performing COIN operations in permissive air environments similar to those found in Iraq and Afghanistan. Despite their extensive use as ISR platforms, the legacy fighter‘s noise signature and size are ill suited for this critical task. In addition, the legacy aircraft‘s limited endurance often forces it to leave the target area to refuel more often than persistent systems like the Predator, Reaper, and Global Hawk unmanned aerial systems.

This constant activity quickly runs up costs that are ultimately paid by both the U.S. Air Force and the American public. Front line fighters are accumulating flight hours in a much shorter time span than was ever anticipated prior to the start of major combat operations. Meanwhile, pilots lose proficiency in their design operational capability (DOC) tasks as they orbit for long periods with few opportunities to employ ordnance. This effort requires extensive logistic support. Fleets of KC-135 and KC-10 tanker aircraft fly round the clock to provide fuel for the F-15E, F-16, and A-10 aircraft serving on the front line in America‘s war on terror. Meanwhile, at deployed locations across the Middle East, men and women struggle to ensure these complex weapon systems meet

their daily tasks. A mission specialized, lightweight, ground attack aircraft could provide solutions to many of these problems.

As the U.S. Air Force continues to shift its focus toward supporting counterinsurgency operations in Iraq and Afghanistan, more mission specialized aircraft are finding their way into the Air Force's inventory. The most recent example is the MC-12. On July 1, 2008, the Secretary of Defense ordered the Air Force to proceed with the procurement of 37 "C-12 class" aircraft to augment unmanned systems.[2] The desired aircraft configuration included Full Motion Video (FMV) and Signals Intelligence (SIGINT) capability in order to provide near real time intelligence to ground forces. The U.S. Air Force began the process of procuring and modifying aircraft as quickly as possible. The first delivery of the modified C-12 aircraft renamed the MC-12 "Liberty" occurred in March 2009.

In addition to ISR platforms, the Air Force is also considering a transformational project for providing low cost fire support to forces engaged in counterinsurgency operations. The Air Force calls this concept the OA-X or AT-X. The OA-X concept involves fielding a lightweight ground attack aircraft to perform CAS and ISR in counterinsurgency operations. The OA-X has seen increasing support in Air Force circles largely due to growing risks associated with continued reliance on legacy fighters for counterinsurgency operations. These risks include significantly reduced airframe life, reduced flight crew proficiency in their primary declared operational capabilities, and ballooning support costs. In order to offset these risks, Air Combat Command is proposing the following.

> Fielding of a light attack/observation aircraft, referred to as OA-X, in support of Combatant Commanders' (CCDR) close air support (CAS), armed reconnaissance, building partnership capacity (BPC) and combat air forces (CAF) training requirements.[3]

This study will examine the costs and benefits of fielding a force of lightweight, manned, ground attack aircraft as the primary aerial platform for fighting low intensity conflicts and counter insurgency operations.

## Primary Research Question

What are the costs and benefits associated with fielding a force of low cost, lightweight, manned, ground attack aircraft outfitted with commercial off the shelf (COTS) avionics and sensors, and employing them in low intensity conflicts and counter insurgency operations?

## Secondary Research Questions

1. What are the current annual costs associated with fielding legacy fighters in combat operations in Afghanistan and Iraq?

2. What are the estimated costs associated with fielding and operating a low cost, lightweight, ground attack aircraft?

3. What are the comparative combat capabilities of legacy fighter aircraft and lightweight ground attack aircraft?

4. How do the historical loss rates of lightweight ground attack aircraft compare to jet aircraft in combat and counter insurgency operations?

5. What peacetime roles could a lightweight ground attack aircraft effectively fill?

## Significance

Fielding a lightweight ground attack aircraft could benefit the United States Air Force by enabling it to redeploy the bulk of its legacy fighter fleet back to bases in the continental United States to resume peacetime training commensurate with their designed operational capabilities statements. This redeployment would effectively reduce annual flight times and thereby extend expected service life. Tanker assets required to support combat operations in theater could also be cut due to decreased fuel consumption and fewer remaining aircraft in theater requiring aerial refueling. The lower hourly operating costs of a lightweight ground attack aircraft could significantly reduce the Air Force's operating and support (O&S) expenditures for operations in OIF and OEF. In addition, the lightweight ground attack aircraft's longer loiter times and decreased support requirements coupled with the ability to operate from austere airfields could increase combat flexibility.

In the continental United States (CONUS), lightweight ground attack aircraft could also enable increased Joint Terminal Attack Controller (JTAC) production by filling a crucial air support gap. Currently, a mix of legacy fighters and contractor aircraft perform this service. The contractor aircraft lack many capabilities required in the contemporary operating environment and therefore limit the quality of training provided. A lightweight ground attack aircraft could significantly reduce costs while increasing both the quality of training and quantity of JTACs graduating from qualification and re-currency training.

However, factors such as reduced combat capability leading to decreased survivability in addition to limited roles and missions beyond counterinsurgency

operations could negate these economic advantages. This study will examine the affordability of fielding a lightweight ground attack aircraft and analyze its combat capability and survivability compared to legacy fighters currently in the U.S. Air Force inventory. Additionally, the study will examine the aircraft's relevance in both contingency and non-contingency operations.

## Assumptions

This thesis assumes the United States will continue to engage in stability and counterinsurgency operations similar to those described in the *National Defense Strategy of the United States of America 2008*. It also assumes, budgetary constraints will hamper advanced military fighter procurement for at least the next five years forcing a continued reliance on legacy fighters to fill CAS and ISR roles in COIN operations. This study anticipates there will be no major changes in operations and maintenance costs for legacy fighters in the next five years and that average sortie durations and the resulting increased rate in total aircraft flight hours will remain constant for aircraft involved in COIN operations in OIF and OEF. Finally, current projected requirements for JTACs supporting U.S. Army maneuver units and fire support requirements in combat operations will continue to increase at predictable rates over the next five years.

## Definitions

Close Air Support. CAS is air action by fixed- and rotary-wing aircraft against hostile targets that are in close proximity to friendly forces and that require detailed integration of each air mission with the fire and movement of those forces.[4]

DOC Statement. The stated missions for which a unit has been equipped, organized, or designed.[5]

Legacy Fighter. Fighter Aircraft fielded after the close of the Vietnam conflict but prior to the fielding of the F-22 Raptor.

(O&S) Costs. The Operations & Support cost category is a major part of the Life-Cycle Cost (LCC) of a weapon system. O&S cost estimates are developed by accumulating personnel and material costs, both of a direct and indirect nature, which the Air Force incurs while operating, maintaining, and supporting the hardware and software of a weapon system.[6]

## Limitations

This study will rely on U.S. Air Force sources and aircraft manufacturer's estimates for data relating to program production costs for a fully configured lightweight ground attack aircraft. Proprietary information pertaining to the advertised costs, capabilities, and limitations of the AT-6B lightweight ground attack aircraft, and not obtainable through open source documents, will not be printed in this study.

## Delimitations

This study will only discuss U.S. Air Force aircraft. In addition, the study will focus on the Hawker-Beechcraft AT-6B as a representative model of a class of lightweight ground attack aircraft that also includes the Embraer EMB 314 Super Tucano, and the Stavatti Aerospace SM-27 Machete. Although particular performance characteristics vary slightly between these airframes, they are similar enough for any one of them to remain generally representative of the group as a whole. The Hawker-

Beechcraft AT-6B was chosen as the representative model due to the U.S. Air Force's familiarity with both the economic and maintenance characteristics of its predecessor the Raytheon T-6A Texan II. In addition, the AT-6B is based on a production aircraft with qualified weapons stores and well-known flight performance. This study will only discuss a single aircraft configuration outfitted with COTS hardware and software technologies currently available from suppliers. The study will not consider capabilities currently under research and development with the U.S. Air Force and aircraft manufacturers. In addition, the study will not consider jet propelled, ground attack aircraft like the Hawk, Alpha Jet, or Aermacchi due to their performance characteristics too closely matching those of current legacy fighter aircraft.

Figure 1. Artists Rendition of the Hawker Beechcraft AT-6B.
*Source:* Hawker Beechcraft, *Beechcraft AT-6B*, Briefing (Wichita: Hawker Beechcraft, 2008).

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[1]Douglas N. Campbell, *The Warthog and the Close Air Support Debate* (Annapolis, MD: Naval Institute Press, 2003), 14.

[2]Global Security.org, *MC-12W Liberty*, January 28, 2009, http://www.global security.org/inyell/systems/mc-12-liberty.htm (accessed February 22, 2009).

[3]Lt Col. Michael W. Pietrucha, Lt Col. Mike Saridakis, and Lt Col. J. David Torres-Laboy, *OA-X Enabling Concept* (Langley AFB: Air Combat Command, 2008), 1.

[4]Joint Doctrine Center, Joint publication 3-09.3, *Joint Tactics, Techniques, and Procedures for Close Air Support (CAS)* (Washington, DC: Government Printing Office, 2003).

[5]Capt. Douglas Harrison, *Designed Operational Capabilities Statements and Status of Resources and Training Systems (SORTS)*, October 1995, http://www.fas.org/man/ dod-101/usaf/docs/cwpc/2800-DO.htm (accessed October 20, 2008).

[6]SAF/FMCCF, Air Force Instruction 65-503 (Washington, DC: Government Printing Office, 1994), 2.

# CHAPTER 2

# LITERATURE REVIEW

This study examines the costs and benefits of fielding a lightweight ground attack aircraft to support air operations in counter insurgency and stability operations. Since 2001, U.S. Air Force legacy fighter aircraft including the F-16 C/D, F-15E, and A-10 have flown combat sorties far exceeding standard peacetime durations during multiple combat deployments to OEF and OIF. These longer sortie durations added significant unanticipated flight time to aging airframes thereby reducing the expected service life of the U.S. Air Force's legacy fighter fleet. Support aircraft including the KC-135 and KC-10 also accumulated far more hours than originally planned while supporting combat operations in OEF and OIF. In order to preserve a rapidly aging fighter and aerial tanker fleet, the U.S. Air Force must provide effective CAS and ISR support to ground forces while simultaneously lowering flight time and O&S costs for legacy fighters and associated support aircraft. One possible solution is fielding a propeller driven lightweight ground attack aircraft.

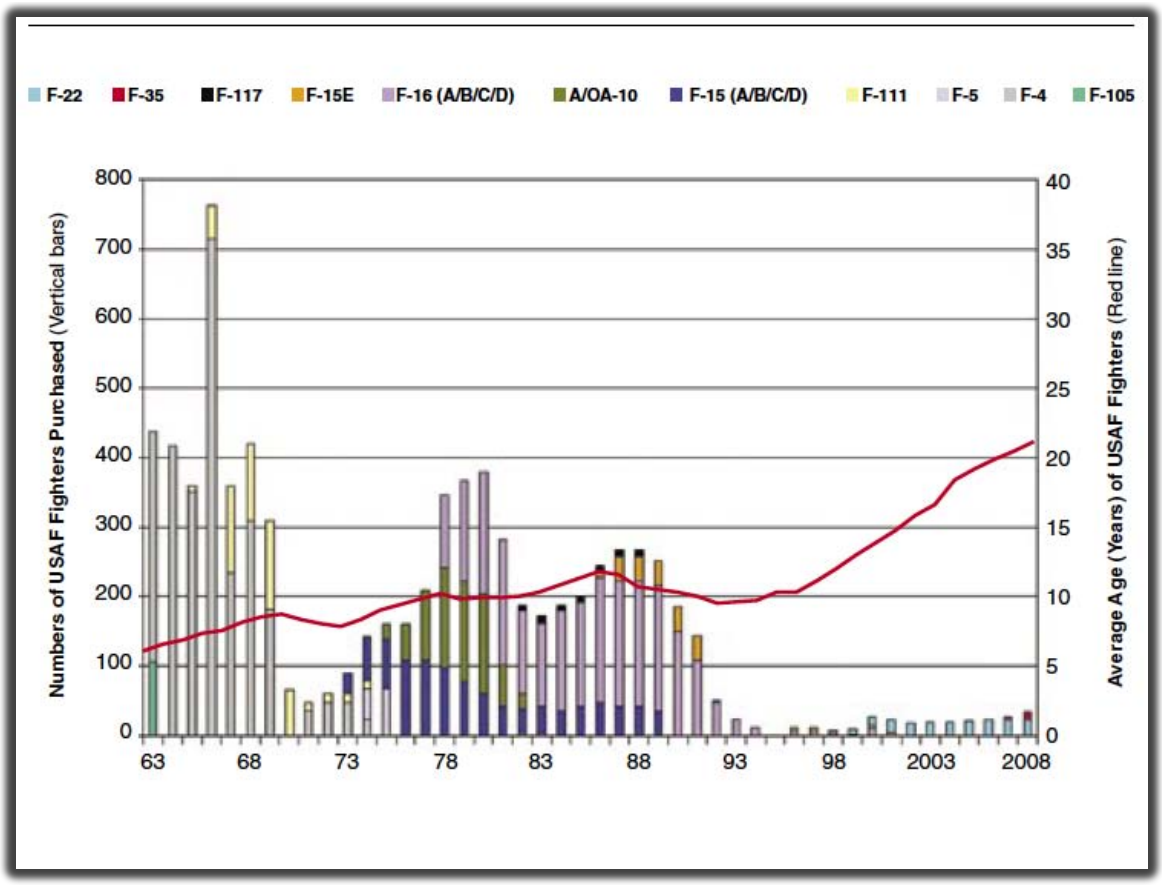


Figure 2. Air Force Fighter Fleet Age.
*Source:* Air Force Magazine, *Air Force Fighters: Dwindling Purchases, Rising Age,* March 20, 2009, http://www.airforce-magazine.com/MagazineArchive/Magazine%20Documents/2009/March%202009/0309chart.pdf (accessed April 7, 2009).

The following chapter discusses the literature used to answer the primary and secondary research questions presented in chapter 1. The chapter starts with an assessment of the scope of literature pertinent to fielding a lightweight ground attack aircraft. It then moves on to discuss U.S. Air Force and U.S. Army internal official reports and draft documents, masters theses, aircraft corporate sales briefs, General Accounting Office Reports, Congressional Research Studies, and RAND Corporation

Reports. While this material is the primary focus of this chapter, books, professional journals, civilian research papers, and other media are also briefly discussed.

There have been three recent masters theses written by U.S. Air Force officers that deal with fielding a lightweight ground attack aircraft. This study both looks back to and builds upon these works. The first, by Major Arthur D. Davis, entitled *Back to the Basics: An Aviation Solution to Counter Insurgent Warfare* was written in April 2005 and focused on historical examples including the French experience in Algeria and the U.S. experience in Vietnam as they apply to COIN operations today. During both of these conflicts, lightweight propeller driven ground attack aircraft were used to fight insurgents in two very different geographic areas and operating environments. Major Davis advocates a re-evaluation of the current U.S. fighter inventory, then recommends a variant of the T-6A Texan II, or something similar, to serve as the premier COIN aircraft in the U.S. arsenal. He does an excellent job identifying and describing the attributes required for a successful COIN aircraft. Major Davis did not delve into economic factors, specific avionics and weapons systems found in modern lightweight ground attack aircraft, or possible peacetime roles and missions. Although he briefly covered survivability, his paper hints at the need for more exploration in this area. In the paper, he relates that by 1960, the increasing anti-aircraft artillery capabilities of the *Army de Libération Nationale* (ALN) coupled with the end of the aircraft's useful life span, forced the French to transition from the A-1 Skyraider propeller driven aircraft to the jet propelled A-4D Skyhawk.[1] Since the U.S. Air Force used the A-1 Skyraider in Vietnam well into the 1970's, it is reasonable to assume that anti-aircraft artillery effectiveness played a large role in influencing the decision to transition from propeller to jet aircraft.

A second masters thesis dealing with the subject and written by Major Brett R. Blake is entitled *AT-6: The Best USAF Investment for the Long War*. Written in 2007, Major Blake's paper concentrated on the cost effectiveness of using the AT-6 to replace current legacy platforms performing counterinsurgency operations in Iraq and Afghanistan. Major Blake did a good job tying the AT-6 to the national strategy for the Global War on Terror and elements of the Quadrennial Defense Review. Major Blake also drew data from Major Davis' *Back to the Basics: An Aviation Solution to Counter Insurgent Warfare* to establish a historical perspective on the effectiveness of lightweight ground attack aircraft in COIN operations as well as the desired attributes for such an aircraft. He then described how the demand for increased persistence in COIN operations often proves physically demanding for both man and machine. In touting the effectiveness of propeller driven aircraft in the ground attack role, Major Blake quoted a Joint Chiefs of Staff Report from 1968, stating the ~~–s~~study has shown propeller- driven craft to be nine times as effective as jet aircraft per sortie in killing trucks and watercraft."[2] However, he failed to mention that in the same report the Joint Chiefs noted propeller aircraft had experienced loss rates up to five times higher than those of jet aircraft.[3] Major Blake also compared the estimated hourly operating costs and maintenance man-hour requirements for legacy fighters and the AT-6. The Air Combat Command staff later refined these estimates, which are published in this study, in order to provide a more complete picture of the costs associated with operating legacy fighters and the AT-6B. Major Blake did not delve into the AT-6B's specific avionics and weapons configurations and how they compare with current legacy aircraft. In addition, he did not juxtapose the historical effectiveness of lightweight ground attack aircraft with

their loss rates in combat. Finally, Major Blake made only passing mention of the potential peacetime roles for the AT-6B.

The masters thesis by Major David L. Peeler Jr. entitled *A Method & Estimate for Counterinsurgency Aircraft Procurement* written in 2008, detailed a process and method to procure counterinsurgency aircraft. The paper focused on the U.S. Special Operations Command's acquisition authority ~~to~~ couple its GWOT mission responsibility with commercial-off-the-shelf aircraft procurement to specifically address the need for an airborne COIN capability."[4] In addition, Major Peeler compared the acquisition processes, performance, schedule, and cost information for Raytheon's T-6A NTA and Stavatti's SM-27.[5] Major Peeler then made recommendations on the basis of performance, schedule, and cost. Major Peeler also produced cost estimates for procuring lightweight ground attack aircraft that are used in later Air Combat Command internal memoranda, and as a result, are cited in this paper. Major Peeler did not discuss survivability, combat capability when compared with legacy fighter aircraft, or potential peacetime roles and missions for a lightweight ground attack aircraft.

Despite several scholarly articles advocating propeller driven lightweight ground attack aircraft, until recently, the idea of using these aircraft in combat operations seemed to have faded from the consciousness of most mainstream airpower advocates. This occurred in spite of the fact that propeller driven aircraft performed ground attack and observation missions in every war the United States participated in prior to the late 1990s. The last propeller driven observation and attack aircraft, the OV-10 Bronco, was finally retired from the U.S. Air Force inventory in 1994. After the Air Force chose the A-10 Thunderbolt II as its primary close air support platform, the idea of using propeller

driven attack aircraft in the ground attack role seemed archaic at best. However, a steady demand remained for propeller driven aircraft due to the American military's dependency on Unmanned Aerial Vehicles (UAV) for persistent ISR coverage. As the UAV assumed larger portions of the CAS mission in both OIF and OEF, the concept of using manned propeller driven aircraft in the CAS role also made a dramatic resurgence. This resurgence may also be the indirect result of events that transpired in May 2007 when the 337th Aeronautical Systems Group at Wright-Patterson AFB submitted a Request for Information for a COIN aircraft for the Iraqi Air Force (IqAF).[6] Since then, a new crop U.S. Air Force officers has become familiar with the capabilities of aircraft like the Hawker-Beechcraft AT-6B and the potential benefits associated with fielding a lightweight ground attack aircraft. The idea has continued to gather momentum since then.

Most of the official analysis concerning a low cost ground attack aircraft originated in the United States Air Force's Air Combat Command (ACC). Staff officers in the Air Combat Command's Joint Air Ground Combat Division (A3F) authored several position papers detailing the requirements for the OA-X concept. The research highlighted the fact that U.S. Air Force's involvement in over seventeen years of continuous combat operations has led to financial inefficiencies and an unusually high operations tempo for aircraft currently in service. In a draft report entitled *A New Light Attack Aircraft: Making the Case for the Current Fight and Preparing for Future Conflicts,* the A3F staff stated;

> We are currently engaged in a protracted campaign fighting the Global War on Terror against transnational terrorists and insurgents while supporting partner nations around the globe. With the force we have developed and shaped for

> Major Combat Operations (MCO), our conventional AF assets support all of the irregular warfare (IW) missions (Counter Insurgency, Counter Terrorism, Building Partnership Capacity (BPC), ISR, Information Operations, Mobility, Agile Combat Support, Command and Control, and Precision Engagement)--but at a large and inefficient price. Our high-tech AF is still required to counter future near-peer threats, but we desperately lack a ―right-tech" solution to the irregular fight. IW missions should not be at the expense of our current conventional posture, but should be additive to our mission set--we have to be able to apply Air Power across the full spectrum of conflict. Reducing our MCO posture should be the last recourse and procuring a new Light Attack Aircraft to compliment our existing fleets is preferred.[7]

The Air Combat Command staff papers specifically detailed the lightweight ground attack aircraft's desired performance characteristics and combat capabilities as well as its intended roles and missions. The papers specified,

> Requirements called for the following: a Commercial-Off-The Shelf (COTS) aircraft modified to perform COIN operations; this aircraft must be a lightly armored, 2-seat, turbo-prop aircraft capable of locating, tracking, identifying, and engaging a variety of targets with a suite of Electro-Optical/Infrared (EO/IR) sensors and laser-guided/unguided air-to-ground weapons/missiles; it must be able to share data and imagery with other COIN aircraft and current IqAF Intelligence Surveillance and Reconnaissance (ISR) and Counter Terrorism (CT) aircraft; and it must incorporate an IR threat detection and countermeasure system and be capable of performing a dual role as an advanced fixed-wing flight trainer aircraft. Additionally, there were many specific requirements like austere field capable, combat range, loiter time, weapons payloads, ejection seats, NVG compatible cockpits, IFR avionics, etc.[8]

One of the primary enablers for cost savings is the OA-X concept's reliance on COTS technology to provide low cost fire support to forces engaged in counterinsurgency operations. This aircraft is one of several new acquisitions that are intended to transform the U.S. Air Force's fleet into a more responsive, low cost instrument for fighting the war on terror and future counterinsurgencies. ACC documents provided insight into the concept of operations for these aircraft and how they fit into the nation's overarching strategy for fighting counterinsurgencies. However, while the draft report entitled *A New Light Attack Aircraft: Making the Case for the*

*Current Fight and Preparing for Future Conflicts* described the future operational benefits of a low cost ground attack aircraft, it failed to make a direct link between the proposed requirement and directives found in the National Security Strategy of the United States of America. This oversight was later corrected in several briefings describing AT-6B requirements. Overall, ACC delivered sound business reasoning to back its stated requirement in addition to spelling out the strengths and weaknesses of the potential procurement program.

Headquarters United States Air Force seemed to agree with the need for a transformational ground attack aircraft. In a briefing entitled *Air Force Lessons Learned Issue Review (L2IR) March 2008,* Headquarters United States Air Force voiced a similar opinion concerning its force structure. In a slide entitled "Potential for Light Attack Aircraft," Headquarters United States Air Force stated:

> The current strike aircraft in Southwest Asia, the A-10, B-1B, F-15E, F-16C+/CG/CJ, F/A-18 C/E/F, GR-7/9 and non-CFACC assets are 'overqualified' for the majority of the missions they are tasked to perform; While there are a few specific missions which require the speed and firepower of advanced tactical aircraft, the vast preponderance of missions could be performed by a light attack aircraft such as the AT-6 or similar aircraft.[9]

Air Combat Command research also presented cost and performance estimates for procuring an aircraft like the AT-6B, often leveraging data presented in a series of proprietary briefs produced by the Hawker-Beechcraft aircraft corporation. These briefs detailed the Hawker-Beechcraft AT-6B's performance capabilities, acquisition program specifics, technical solutions and operating concepts. Because the AT-6B is a potential entrant in future lightweight ground attack aircraft contract competitions, the literature very smartly tied the AT-6B directly to the current National Security, Homeland Defense, and Global War on Terror Strategies of the United States of America in addition to the

Quadrennial Defense Review. These briefs also tied the aircraft‘s capabilities directly to military requirements expressed in the various services‘ internal tactics manuals and doctrine. Although essentially sales brochures targeting General Officers and civilian officials serving in the United States Congress, the Air Staff, Headquarters United States Marine Corps, the Joint Staff, Air Force Special Operations Command, Air Combat Command, the Air National Guard, and Pacific Air Forces, the briefs went to great lengths to explain the AT-6B‘s niche role in today‘s unique security environment. Hawker-Beechcraft effectively argued this environment requires a CAS platform with increased persistence, sustainability, responsiveness, lethality, and interoperability. Hawker-Beechcraft readily admitted the AT-6B may not be as survivable as the Air Force‘s legacy fighters when pitted against radar guided surface-to-air missile systems and medium to heavy caliber anti-aircraft artillery, and the brief clearly articulated the airplane is optimized for use in more permissive air environments. These briefs also capitalized on the military‘s prediction that the most likely future threats facing the United States are relatively unsophisticated terrorist and paramilitary groups possessing few if any complex anti-aircraft defensive systems. The AT-6B literature promised a low cost package with extended persistence and a wealth of sensor and communications options similar to those found on current UAV and legacy fighter aircraft. Hawker-Beechcraft asserted this improved flexibility can be delivered at a cost that will purportedly save the American taxpayer $1.9 billion per year.[10] The briefs also detailed a myriad of different missions suitable for the AT-6B before going on to detail the solid performance of the AT-6B‘s progenitor the T-6A Texan II.

ACC research also documented the military's greatly expanding need for qualified Joint Terminal Attack Controllers (JTAC) in COIN operations. This is a topic that has recently become intertwined with peacetime requirements for aircraft like the lightweight ground attack fighter. As early as 2004, the U.S. Army's Office of the Deputy Chief of Staff (G-3) identified the need for more JTACs in U.S. Army maneuver units. In order to train the additional personnel, ACC will have to generate more CAS sorties than currently possible with its legacy fighter fleet. This is one of the least glamorous but most compelling arguments for procuring a lightweight ground attack aircraft. Air Force sources independent of the, Joint Air Ground Combat Division (A3F) also document the requirement for additional CAS and forward air controller (airborne) (FAC (A)) assets in the training arena. In a briefing to the Headquarters Air Combat Command entitled, *USAF AGOS State of the CAS Union*, Colonel Thomas Webster highlighted U.S. Army plans to field JTACs at the company level. This manpower change will force the U.S. Army and U.S. Air Force to maintain approximately 2,000 trained JTACs in the field at any one time.[11] This requirement is problematic due to a lack of training support assets including fighter-attack aircraft and the specialized training institutions that produce qualified JTACs for the U. S. Army and U.S. Air Force.

The largest JTAC training school in the United States is administered and executed by the 6th Combat Training Squadron at Nellis Air Force Base, Nevada. The school currently trains approximately 1,000 students per year originating from the U.S. Army, U.S. Air Force, U.S. Marine Corps, and coalition partners. Of these 1000 students, the U.S. Army currently accounts for only about 33 percent, or roughly 330 students per year and none of these students actually go through the training track that

produces a qualified JTAC. In fact, the course only produces approximately 120 JTACs annually. In his brief *USAF AGOS State of the CAS Union,* Colonel Webster clearly identified inadequate levels of available CAS and FAC (A) sorties as one of the insurmountable hurdles to training the increased number of JTACs required by the U.S. Army for future operations. Colonel Webster also deftly hinted at the idea of using a new aircraft to make up for the shortfall and accomplish additional training. He pointed out several problems associated with relying on fighters like the F-16 C/D and A-10 to provide the sorties required for increased JTAC training. He also highlighted difficulties arising from the military's future reliance on the F-35 as its primary FAC (A) platform. He did not go so far as to recommend the acquisition of a new aircraft to support the increased requirement for FAC(A) and CAS sorties in order to support training requirements, but this was most likely due to the scope of the briefing and the intended audience.

Colonel Jeff Pettigrew's informational brief to the Air Staff entitled the *JTAC Train Wreck* built on the assertions made by Colonel Webster. In his briefing, Colonel Pettigrew listed decreasing fighter forces, a rapidly aging fighter fleet, rising fighter operations and maintenance costs, and prohibitively expensive new fighter acquisitions as major obstacles to obtaining required close air support sorties for JTAC training. Colonel Pettigrew used U.S. Air Force numbers for operations and maintenance costs, also cited in Major Brett R. Blake's *AT-6: The Best USAF Investment for the Long War,* to demonstrate the relative cost of supporting JTAC training with legacy fighter aircraft as compared to the AT-6B. He then presented three possible courses of action to remedy the difficulties inherent in sustaining the required JTAC personnel pool. These possible

courses of action included reducing the combat air force's available JTAC pool, gaining additional funding for fighter operations and maintenance, and finally purchasing a lightweight ground attack aircraft.[12]

Several of the issues highlighted in Colonels Webster and Pettigrew's briefs were also mirrored in a brief entitled, *Combined Arms Center Air-Ground Operations Update* presented by U.S. Army General Kevin P. Byrnes, former commander of the U.S. Army Training and Doctrine Command.[13] In his brief, GEN Byrnes identified the requirement for a marked increase in JTAC production. However, he failed to specifically identify the marked increase in both FAC (A) and CAS sorties required to support this training. He did hint at the issue, however, by stating that any school producing JTAC qualified personnel would require an appropriate simulator to make up for the training presumably unavailable due to lack of U.S. Air Force support assets. "Simulations for air-ground operations (including CAS) are essential for feasible COAs to train and sustain proficiency in air-ground operations."[14] GEN Byrnes indicated the U.S. Army may have to consider opening its own JTAC training school, but once again, GEN Bynes did not identify the need for increased sorties to support such an effort. He seemed to rely instead upon an appropriate simulation device and delved no deeper into this portion of the problem.

However, the United States General Accounting Office (GAO) provided a dissenting opinion concerning the effectiveness of simulations for training JTACs. In its May 2003 report to Congress entitled, *Military Readiness: Lingering Training and Equipment Issues Hamper Support of Ground Forces*, the GAO discounted the wisdom

of relying on simulators as the primary means of training air and ground personnel terminal attack control procedures. In its report, the GAO stated:

> Pilots, controllers, and ground commanders from the services that are involved in joint close air support need to train together frequently in order to develop confidence in one another and become familiar with one another's procedures. Without such regular exercises, pilots are not willing to fully trust the instructions they receive from controllers, and ground commanders are not confident that the air support will be timely and accurate.[15]

The military is not the only organization within the federal government concerned with ground attack capabilities relevant to low intensity conflict and COIN operations. The Congressional Research Service (CRS) and the RAND Cooperation have both commissioned reports since 2001 detailing projected requirements for future capabilities essential for conducting counter-terror and COIN operations.[16] While both agencies have discussed the role of current procurement programs in COIN operations, neither agency has mentioned the possibility of the U.S Air Force procuring a lightweight ground attack aircraft.

The CRS reports covered a full range of topics including options for combating terrorism, special operations, aircraft procurement and modernization, and tactical air integration. CRS reports identified the need for military and civilian leaders to adjust their mindset when confronting non-state actors and also identified CAS as a primary mission set in the fight against non-state actors.

> Close air support (CAS) is a military aviation mission that appears highly relevant to the non-state actor challenge. Many of the functions inherent in CAS, such as tracking enemy forces, differentiating friendly forces from foes, quickly delivering weapons against moving targets, and closely controlling and coordinating air and ground forces to reduce the chances of fratricide or collateral damage, are applicable to air-actions against non-state actors. Therefore, assessing how the CAS mission is evolving, what key challenges are inherent in the mission, and how these challenges are currently being addressed should

> provide a useful framework for assessing how military aviation may be applied against non-state actors.[17]

The reports stated ―successfully combating non-state actors will likely require different training, tactics, doctrine, political strategies, and potentially rules of engagement, than are optimal for conventional military warfare."[18] The CRS generally tended to focus on modifications in tactics and strategies pertinent to currently planned or fielded aircraft and weapon systems. However, they failed to consider fielding new force structures despite the recent push for military transformation. This was most likely due to the context in which the reports were written, the time and money invested in current procurement programs, and an unwillingness to compromise traditional combat capabilities in order to field a fleet of aircraft to deal with non-traditional threats.

CRS analysts Bolkcom and Katzman commented at length about the U.S. military's ability to mold the capabilities of existing platforms to stated requirements for fighting asymmetric threats. These platforms include the A-10, C-130, Joint Strike Fighter (also known as the F-35 Lightening II), F-18 Super Hornet, and a medium range bomber version of the Air Force's F-22 Raptor air superiority fighter. In fact, as late as 2006, in his report titled *Air Force Transformation* Bolkcom failed to make any mention of a potential lightweight ground attack aircraft program.[19] It is likely the authors overlooked the lightweight ground attack aircraft option because the concept of procuring this type of aircraft was not under consideration by the services at the time the report was written.

The RAND Corporation has also written several studies dealing with issues pertinent to a lightweight ground attack aircraft. In a report discussing the Tactical Air Control System (TACS), the RAND Corporation stated, ―Fixed wing air (i.e., fast-

movers) is not terribly well suited to the sorts of CAS challenges faced in irregular warfare (IW). It is neither very effective nor very efficient."[20] Although, this is one of the primary arguments for employing a low cost ground attack aircraft, the RAND Corporation failed to make a connection between the service's increasing need for CAS in the fight against non-state actors and a shift to a cheaper, more persistent, and more supportable platform. In the report titled, *United States Air and Space Power in the 21st Century*, Zalmay Khalilzad and Jeremy Shapiro also failed to mention close air support aircraft as an area for recapitalization and modernization, but they pointed to the fact that:

> To support the wide range of U.S. interests and to give policymakers options, the Air Force must, among other things, continue to develop new concepts and systems, modernize and recapitalize its aging fleet of combat and support aircraft, and continue to reinvent the way it does business.[21]

The documentation indicated the push toward fielding a lightweight ground attack aircraft for the U.S. Air Force is an idea that has only recently emerged from the Air Force's distant past and placed itself squarely on the path to its immediate future.

Beyond the research reports written since 2005 and the historical literature discussing the exploits of aircraft like the F-51 Mustang, B-26 Marauder, and the A-1 Skyraider, there is very little serious literature outside the various staff offices of the U. S. Air Force and a select number of aircraft manufacturers that concentrates on fielding a lightweight ground attack aircraft. However, the U.S. Air Force position papers along with recent headlines emanating from the Office of the Secretary of Defense point to the idea's increasing momentum within the Department of Defense. This study will further examine the costs and benefits associated with fielding a lightweight ground attack aircraft for use in contingency and non-contingency operations.

In chapter 3, the author will discuss the methodology used in this thesis. Using the literature discussed in chapter 2, the author will answer the primary and secondary research questions posed in chapter 1. The study will also take into account the values and validity of the assumptions contributing to the conclusions presented by the various sources when discussing the answers to the research questions. The findings of this study will lead to conclusions and recommendations for fielding a lightweight attack aircraft in the United States Air Force.

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[1]Maj. Arthur D. Davis, "Back to the Basics: An Aviation Solution to Counter-Insurgent Warfare" (Masters Thesis Air Command and Staff College, Maxwell AFB, 2005), 15.

[2]Joint Chiefs of Staff, *The Use of Propeller and Jet Aircraft in Laos*, Memorandum for the Secretary of Defense (Washington, DC: Office of the Joint Chiefs of Staff, 1968).

[3]Ibid.

[4]Maj. David L. Peeler Jr., "A Method & Estimate for Counterinsurgency Aircraft Procurement," *Small Wars Journal* (February 2008): 5.

[5]The T-6A NTA is an armed version of the T-6A for the Hellenic Air Force and a precursor to what eventually became the AT-6B.

[6]Lt Col. J. David Torres-Laboy, *A New Light Attack Aircraft: Making the Case for the Current Fight and Preparing for Future Conflicts*, Draft White Paper (Langley Air Force Base, Virginia: Air Combat Command, 2008), 2.

[7]Ibid., 4.

[8]Ibid., 2.

[9]Headquarters, U.S. Air Force, *Air Force Lessons Learned Issue Review (L2IR) Mar 2008*, Air Force Lessons Learned Issue Review (L2IR) (Washington, DC: Headquarters U.S. Air Force, 2008).

[10]Hawker Beechcraft, *Beechcraft AT-6B*, Briefing (Wichita: Hawker Beechcraft, 2008).

[11]Col. Thomas Webster, *USAF AGOS State of the CAS Union*, Power Point Presentation, 93 AFOW, Moody AFB, GA, February 18, 2009.

[12]Col. Jeff Pettigrew, *The JTAC Trainwreck*, Briefing, 194th Air Support Operations Group, 2008.

[13]GEN. Kevin P. Byrnes, *Combined Arms Center Air-Ground Operations Update,* Fort Leavenworth, Kansas, February 24, 2004.

[14]Ibid.

[15]U.S. General Accounting Office, *Military Readiness: Lingering Training and Equipment Issues Hamper Air Support of Ground Forces* (Washington, DC: General Accounting Office, 2003).

[16]The CRS supports the national legislature by developing creative approaches to policy analysis, anticipating legislative needs and responding to specific requests from legislators in a timely manner.

[17]Kenneth Katzman, and Christopher Bolkcom, CRS Report for Congress, *Military Aviation: Issues and Options for Combating Terrorism and Counterinsurgency* (Washington, DC: Congressional Research Service, 2006).

[18]Ibid.

[19]Christopher Bolkcom, CRS Report for Congress, *Air Force Transformation*, (Washington, DC: Library of Congress, 2006), 6.

[20]RAND, Project Air Force Research Brief, *Beyond Close Air Support: Forging a New-Air Ground Partnership* (Santa Monica: RAND, 2005).

[21]RAND, Project Air Force, *United States Air and Space Power in the 21st Century* (Santa Monica: RAND, 2007), 46.

# CHAPTER 3

# RESEARCH METHODOLOGY

This study examines the costs and benefits of fielding a lightweight ground attack aircraft to support air operations in COIN and stability operations. Since 2001, U.S. Air Force legacy fighter aircraft including the F-16 C/D, F-15E, and A-10 have flown combat sorties far exceeding standard peacetime durations during multiple combat deployments to OEF and OIF. These longer sortie durations added significant unanticipated flight time to aging airframes thereby reducing the expected service life of the U.S. Air Force's legacy fighter fleet. Support aircraft including the KC-135 and KC-10 also accumulated far more hours than originally planned while supporting combat operations in OEF and OIF. In order to preserve a rapidly aging fighter and aerial tanker fleet, the U.S. Air Force must provide effective CAS and ISR support to ground forces while simultaneously lowering flight time and O&S costs for legacy fighters and associated support aircraft. One possible solution is fielding a propeller driven lightweight ground attack aircraft.

The following chapter discusses the methodology used to answer both the primary and secondary research questions. The chapter covers the general methodology, the criteria for using various sources, and the specific methodology used to answer each research question. The strengths and weaknesses of the methodology used to answer each question are also presented.

This study used a document review as the primary research methodology to answer both the primary and secondary research questions. Where required, the researcher contacted the author of a source document in order to confirm the data under

review. Documents reviewed include historical studies dealing with lightweight ground attack aircraft involved in CAS and COIN operations, research papers and masters theses published by various military staff colleges, professional journals, internal U.S. Army and U.S. Air Force documentation, aircraft corporate sales briefs produced by Hawker-Beechcraft, and effectiveness and survivability reports for aircraft involved in CAS and COIN operations. Additional sources included RAND Reports and Congressional Research Service projects concerning the CAS capabilities required to support COIN operations in the contemporary operating environment. Sources germane to fielding lightweight ground attack aircraft included: U.S. military joint doctrine, service specific doctrinal and tactical manuals, various government agency reports, and multiple books, articles, and studies dealing with fires and CAS.

The researcher began collecting data based on a list of sources relevant to the topic prepared by the Air Command and Staff College at Maxwell Air Force Base, Alabama. This bibliography listed many of the recently published books, articles, and research papers dealing with CAS in COIN operations. Additionally, the researcher contacted individuals within the various departments of the U.S. Air Force, U.S. Army, and defense contracting corporations in order to obtain documents germane to fielding a lightweight ground attack aircraft. This search yielded the most recent and relevant information. Examples include aircraft performance characteristics, costs, and requirements tied to fielding a lightweight ground attack aircraft. Although there are hundreds of published works dealing either directly or indirectly with CAS and COIN operations, the study included only those that were relevant to either the primary or

secondary research questions. In addition, the sources cited in this study had to have verifiable expertise pertaining to the subject matter.

As stated, the primary research methodology involved accumulating documentation relevant to CAS in COIN operations or fielding a lightweight ground attack aircraft. The researcher used the information contained in the documentation to answer the primary and secondary research questions. The study cross-referenced multiple sources in order to independently verify data used to answer each of the research questions. In addition, the study incorporated multiple points of view to insure adequate data existed to answer any qualitative arguments regarding a research question. In the case of multiple sources containing conflicting data, every effort was made to ascertain the facts and assumptions underpinning the data in order to determine which source presented the most accurate information. All relevant data is presented in this study along with any conclusions regarding its validity.

The cost estimates used to determine the annual O&S costs for legacy fighter aircraft involved in COIN operations in OIF and OEF were derived from a draft ACC report entitled, *A New Light Attack Aircraft: Making the Case for the Current Fight and Preparing for Future Conflicts.* The costs cited in the ACC report duplicated data contained on the Air Force Portal.com website. These costs are based on a per hour dollar value in FY 2007 dollars. The figures disclosed the O&S costs of various U.S. Air Force aircraft and remain valid regardless of the aircraft‘s operating location. In addition to the hourly O&S cost for individual airframes, this study determined the total annual operation and maintenance budgets for major weapon systems in both contingency and non-contingency operations by referencing the *Department of Defense FY 2009*

*President's Budget, Department of Defense Budget Fiscal Year 2008,* and the *Department of the Air Force Fiscal Year (FY) 2009 Budget Estimates.* These documents were used to determine the total operations and maintenance costs for major weapon systems in contingency and non-contingency operations.

In addition, data from this study cross-referenced a 1999 RAND Study entitled, *Principles for Determining the Air Force Active/ Reserve Mix*, in order to confirm the validity of the hourly operating and support cost estimates listed in both the draft ACC report and the Air Force Portal.com website. The Rand study used a Systematic Approach to Better Long Range Estimating (SABLE) cost model to determine hourly costs per aircraft.

> The SABLE model uses various cost and planning factors to estimate the peacetime operating and support costs of flying units. Operating costs include cost elements in the operation and maintenance, military personnel, and other procurement appropriations. Within these appropriations, the major cost categories include military and civilian pay, aviation fuel, depot level repairable, and consumable supplies. These costs are estimated for each type and model of aircraft within each major command. The SABLE model only addresses variable costs but not any fixed costs. Similarly, it captures direct costs but few indirect costs such as the costs of maintaining the base and runway. The SABLE produces general cost estimates to evaluate force structure options. The estimated savings do not include any military construction, base closure, or other costs that may be associated with transferring aircraft from one specific location to another.[1]

The data contained in the RAND study were developed from the SABLE cost model maintained by SAF/FMC.[2]

The RAND study used FY 1999 dollars, which were converted for comparison to FY 2007 dollars using the *Consumer Price Index (CPI) Conversion Factors to Convert to 2007 Dollars,* published by Oregon State University.[3] Using this data, the researcher determined the costs presented by ACC were actually slightly less than those presented in the RAND study. It was important to independently establish these figures' validity

because they are used in the ACC draft report as well as various sources throughout the U.S. Air Force. Col Jeff Pettigrew referred to these same figures in his argument for using the lightweight ground attack aircraft to support JTAC training in his briefing entitled, *The JTAC Train Wreck*.

Data regarding the comparative Average Sortie Durations (ASD) for aircraft operating at home station versus combat operations in OIF and OEF were verified by comparing the ASD for combat units in Iraq and Afghanistan presented by Major Jason A. Gibson in his research report entitled, *Creative Logistics: The Evolving Ways of Sustaining Conventional Airpower in Irregular Warfare,* and the FY 2007 flying hour program for the 422d Test and Evaluation Squadron (TES) at Nellis Air Force Base, Nevada. The 422d TES flies peacetime test and training missions with legacy fighter aircraft representative of those currently used in OIF and OEF.

This study used data provided by Hawker-Beechcraft Aircraft Corporation to determine potential costs for fielding a lightweight ground attack aircraft. The numbers provided by the company are a cost range expressed in FY 2008 dollars. The final cost could fluctuate across a given price range depending on the final aircraft sensor, avionics, weapons, and suspension equipment configuration ordered by the U.S. Air Force. In addition, the per-unit cost is contingent upon the U.S. Air Force purchasing a set number of aircraft. The individual unit price will fluctuate depending on how many aircraft the Air Force actually purchases. The estimated prices are based largely on known costs associated with related programs. In Hawker-Beechcraft‘s case, the T-6A Texan II trainer aircraft provided a reliable base for most cost estimates associated with fielding an improved base model aircraft. Since the final aircraft configuration will use COTS

technologies, the costs associated with equipping the basic airframe can be estimated without incurring the risks associated with developing new technologies for the program. In addition, the Hawker-Beechcraft Corporation has already fielded an aircraft for the Hellenic Air Force with systems similar to those envisioned by the U.S. Air Force. This study used purchase costs provided by the U.S. Air Force to confirm the accuracy of the purchase cost for the original T-6A Texan II published by the Hawker-Beechcraft Corporation.[4] However, obtaining independent verification of the accuracy of estimated production costs incurred by adding additional sensors, weapons, and avionics to the basic airframe is beyond the scope of this study.

This study compared the performance characteristics of the AT-6B with those of legacy fighters operated by the U.S. Air Force by comparing the technical manuals and open source data for each airframe. The author used the technical orders and flight manuals issued by the U.S. Air Force to confirm open source data printed in fact sheets posted on the Air Force Link.mil website. The author reviewed open source data for the A-10, F-16 C/D, and F-15E legacy fighters as well as the T-6A Texan II trainer. He then used the data for the T-6A as a basis for comparing and confirming the performance characteristics of the AT-6B lightweight ground attack aircraft published on both open source websites and in Air Force internal reports. The author also contacted the Hawker-Beechcraft AT-6B program manager in order to confirm the data.

The study used historical combat loss rate data for several aircraft typically used to support ground forces in both the Vietnam and Korean conflicts. These aircraft included the F-51 Mustang, F-4 Corsair, A-1 Skyraider, O-1 Bird Dog, O-2 Skymaster, and OV-10 Bronco. They were used to provide data pertinent to the potential combat

loss rate for a modern lightweight ground attack aircraft operating in a similar operational environment. These loss rates were then compared to loss rates for jet aircraft including the F-84 Thunderjet, F-86 Saber, F-4 Phantom, F-100 Super Saber, F-105 Thunderchief, and the A-4 Skyhawk. The study used only statistics for aircraft losses sustained in South Vietnam, Laos, Cambodia, and Korea because the threats found in these operating environments more closely match those typically expected in a modern counterinsurgency environment.

The study also relied on data and supporting documentation provided by Col Jeff Pettigrew, in his brief entitled, *The JTAC Train Wreck* to determine the number of sorties needed to fulfill JTAC training requirements for both the U.S. Army and the U.S. Air Force in the coming years. Much of the data presented on this subject is the result of Colonel Pettigrew‘s efforts in this area. The author independently verified much of Colonel Pettigrew‘s data using internal Army and Air Force data contained in official correspondence including a briefing entitled, *TACP State of the Union, Enabling Support to Land Ops,* by Colonel Tom Webster dated 18 February 2009.

This study‘s findings will be discussed in chapter 4. Using the literature discussed in chapter 2, and the methodology discussed in this chapter, the study will present the possible answers to both the primary and secondary research questions posed in chapter 1. The findings of this study will lead to conclusions and recommendations for fielding a lightweight attack aircraft in the United States Air Force.

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[1]U. S. General Accounting Office, *Air Force Aircraft: Consolidating Fighter Squadrons Could Reduce Costs (Letter, Report, 05/06/96, GAO/NSIAD-96-82)* (Washington, DC: Government Printing Office, 1996).

[2]William A. Williams, Albert A. Robbert, and Cynthia R. Cook, *Principles for Determining the Air Force Active/Reserve Mix* (Santa Monica, CA: RAND, 1999).

[3]RAND, Project Air Force Research Brief, *Beyond Close Air Support: Forging a New-Air Ground Partnership* (Santa Monica: RAND, 2005).

[4]Department of the Air Force, *T-6 Texan II Fact Sheet*, October 2005, http://www.af.mil/factsheets/factsheets.asp?fsID=124 (accessed January 9, 2008).

# CHAPTER 4

# ANALYSIS

The author of this study examined the costs and benefits of fielding a lightweight ground attack aircraft to support air operations in COIN and stability operations. Since 2001, U.S. Air Force legacy fighter aircraft including the F-16 C/D, F-15E, and A-10 have flown combat sorties far exceeding standard peacetime durations during multiple combat deployments to OEF and OIF. These longer sortie durations added significant unanticipated flight time to aging airframes thereby reducing the expected service life of the U.S. Air Force's legacy fighter fleet. Support aircraft including the KC-135 and KC-10 also accumulated far more hours than originally planned while supporting combat operations in OEF and OIF. In order to preserve a rapidly aging fighter and aerial tanker fleet, the U.S. Air Force must provide effective CAS and ISR support to ground forces while simultaneously lowering flight time and O&S costs for legacy fighters and associated support aircraft. One possible solution is fielding a propeller driven lightweight ground attack aircraft.

In the following chapter, the author discusses the conclusions and analysis of this study in relation to the primary and secondary research questions. The chapter starts with an introduction then goes on to cover the specific findings for each research question.

## Cost Comparison

The current costs associated with fielding a force of expeditionary combat aircraft on foreign soil are staggering. The U.S. Air Force's budget for operation and maintenance of primary combat forces involved in both contingency and non-

contingency operations peaked at just over $4.5 billion during fiscal year 2007.[1] This number includes supplemental spending particular to the operation and maintenance of primary combat forces. A great deal of the money earmarked for the operation and maintenance budget for these forces is used to pay the hourly operating costs associated with individual airframes. According to the Department of the Air Force's FY 2009 Budget Estimates, primary combat forces are comprised of front-line fighters, bombers, and strike assets including the A/OA-10, B-1, B-2, B-52, F-15, F-16, F-22A, F-35, and MQ-9 aircraft.[2] Of the legacy aircraft listed in this description, the A/OA-10, F-15E, and F-16 C/D experience the most frequent deployments for duty in OIF and OEF. The hourly operating costs for these fighters are listed in Table 1.

Table 1. Aircraft Reimbursement Rates (per Flying Hour) FY 2007.

**Aircraft Reimbursement Rates (per Flying Hour) FY2007***

| MDS | (DOD) | (OTH/FMS) | (PUBLIC) |
|---|---|---|---|
| A-10A | $4,864 | $4,936 | $5,133 |
| F-15C | $14,139 | $14,211 | $14,779 |
| F-15E | $13,991 | $14,134 | $14,700 |
| F-16C | $6,649 | $6,721 | $6,989 |
| F-16D | $6,704 | $6,848 | $7,121 |
| KC-10A | $9,617 | $9,948 | $10,346 |
| KC-135E | $9,426 | $10,577 | $11,000 |
| KC-135R | $7,990 | $8,244 | $8,574 |

*Source:* Data adapted from the Department of the Air Force, *FY2007 Reimbursment Costs*, February 20, 2007, https://www.my.af.mil/gcss-af/USAF/AFP40/attachment/20070207/15-1%20(Feb07)/xls (accessed January 20, 2008). *Categories listed are Department of Defense, Other / Foreign Military Sales, and Public. This is the per-hour cost for these groups to operate the system under lease or purchase.

The A-10 is the cheapest U.S. Air Force manned fighter/attack aircraft used in combat operations against insurgents in Iraq and Afghanistan with an hourly operating cost of just over $5,000 per flight hour while the F-15E is the most expensive fighter to operate at just under $14,000 per flight hour. Tanker aircraft supporting air operations over Iraq and Afghanistan generally costs between $8,000 and $11,000 per flight hour. The B-1 and B-52 bombers supporting the war on terror cost $39,000 and $30,000 per flight hour respectively. The study will not deal with bomber aircraft as they are deployed in limited numbers, provide unique capabilities, and are specifically requested by the combatant commander.

Table 2. Aircraft Unit Costs (Dollars in Millions).

**Aircraft Unit Costs (Dollars in Millions)**

| MDS | FY 98 Constant Dollars / 2007 Dollars[3] (DOD) |
|---|---|
| A-10A | N/A/NA |
| F-15C | $29.9 / 37.99 |
| F-15E | $31.1 / $39.52 |
| F-16C/D | $18.8 / $23.88 |
| KC-10A | $88.4 / $112.33 |
| KC-135E/R | $39.6 / $50.32 |

*Source:* Data adapted from, Department of the Air Force, *Aircraft Factsheets*, September 01, 2008, http://www.af.mil/factsheets/factsheet.asp?fsID=110 (accessed February 8, 2009).

An additional cost that must be considered is the replacement value of any fighter that may be lost as a result of combat action. Table 2 depicts the unit replacement costs for both the fighter/attack and required support aircraft currently deployed to Iraq and

Afghanistan. These numbers are reported in FY (98) constant dollars on the left and converted to 2007 dollars using the *Consumer Price Index (CPI) Conversion Factors to Convert to 2007 Dollars* published by the Political Science Department at Oregon State University. No unit cost is reported for the A-10 because the aircraft is out of production and can no longer be replaced. All costs are for the basic airframe only and do not include any additional sensors, weapons, or suspension equipment.

One of the primary reasons for fielding a low-cost lightweight ground attack aircraft is the savings achieved by purchasing and then operating a cheaper airframe in permissive air environments. In order to identify potential savings, this study used the Hawker-Beechcraft AT-6B as its primary example. The AT-6B is representative of a class of aircraft that also includes the Embraer EMB 314 Super Tucano. This study concentrated on the AT-6B because much of the data presented was verified by referencing its progenitor, the T-6A Texan II trainer, already in service with the U.S. Air Force. According to open-source Internet data, confirmed by Hawker-Beechcraft, that discusses sales of the AT-6B to a foreign partner:

> The cost of the aircraft is very dependent upon the ―s~~―~~ophistication" of the components/sensors, etc., we can provide with the aircraft. For example, selling an AT-6B aircraft to a foreign customer is dependent upon what components are ―e~~―~~xportable" according to State Department guidelines. The T-6 fleet is an International Traffic in Arms Regulations (ITAR) controlled aircraft and we have to obtain permission from the State Department before we can sell the aircraft and training system to a foreign customer. Obviously, commercial off the shelf components such as the FLIR, data link, radios, etc., with low technological capabilities are not as expensive as those systems with encryption, high accuracy, etc. The base price of a T- 6B is approximately $6.0M. Depending upon the customer's requirements and State Department rules, we then will modify the aircraft to include the desired/exportable components. The price range for an AT-6B aircraft would be $8-10M with the low end representing an aircraft with the lower technology sensors. Obviously if a customer came in with a large order of

> 45 aircraft, negotiations on the price could occur based upon an economic quantity buy. [4]

These figures can be partially verified using U.S. Air Force reported replacement cost for the T-6A Texan II trainer. According to the T-6A Texan II factsheet printed on the *Air Force Link* website, the unit cost for the baseline airframe T-6A is $4.72 million.[5] This sum equals approximately $5.64 million in FY 2007 dollars. At $10 million, the AT-6B is over $12 million cheaper to purchase or replace than an F-16C/D and over $29 million cheaper than the F-15E. It must be remembered however, that this is a comparison between very dissimilar aircraft, and the F-16 C/D and F-15E have capabilities that enhance their survivability in the most hostile air environments, whereas the AT-6B requires a relatively benign threat environment to operate successfully.

Aircraft reimbursement rates per flight hour are another area where the AT-6B provides significant savings over legacy fighter aircraft. The estimated flying hour costs for the AT-6B are approximately $1,000 per flight hour.[6] In their initial calculations, ACC estimated a potential annual savings of $325 million if the AT-6B were used to replace one squadron of F-16s and half of the total number of F-15Es currently operating in Afghanistan.[7] J. David Torres-Laboy explained how these savings could be achieved:

> One squadron of F-16s and half of a squadron of F-15Es require about 420,000 pounds of off-loaded fuel from tankers per day. About 6 tankers are required for this offload, using about 160,000 pounds of fuel each. The total fuel savings equal approximately 1 million pounds a day or about 55 million gallons of JP-8 per year just from air refueling operations (6.6 lbs/gallon). At the latest rate of about $2.37 per gallon, the fuel savings alone is approximately $131 million per year.[8]

When using FY 2008 operating costs for fielding legacy fighters, the total savings are significant. If one assumes the lightweight ground attack aircraft operating cost is approximately one thousand dollars per hour, and that all legacy fighter aircraft replaced

in theater will fly their normal peacetime training programs at home stations and with historic ASD rates; in the case of an F-16 squadron, the savings come out to about $248 thousand per day or about $91 million (M) per year.[9] In the case of an F-15E squadron, the savings are approximately $186 thousand per day or $68M per year. The savings gained by reducing the number of tanker aircraft required in theater equal approximately $97 thousand per day or $36 million per year.[10] The total estimated flying hour costs savings obtainable in FY 2008 dollars is approximately $194 million. Therefore:

> The sum of fuel and operating cost savings for one year is $325M in just one year! Looking at our current combat operations and only looking at air refueling operations and flying hour costs, replacing one squadron of F-16s in Iraq and half of the F-15E's in Afghanistan would pay for the acquisition costs of about 36 Light Attack Aircraft.[11]

The numbers presented demonstrate that operating a lightweight ground attack aircraft in contingency operations will garner significant savings for the U.S. Air Force in a relatively short period of time, but cost is not the only variable that must be addressed. The aircraft's survivability in its intended operating environment is another critical consideration in the decision to field a lightweight ground attack aircraft. Once again, this study considered the AT-6B as it is representative of its class of aircraft in important categories including range, speed, payload, weapons, sensors, and avionics. The study first detailed the specific capabilities of the AT-6B. It then compared these capabilities with those of the legacy fighters it would replace in future counterinsurgency operations.

## Combat Capabilities

The AT-6B is a weaponized version of the T-6A Texan II manufactured by the Hawker-Beechcraft Corporation. The T-6A owes its lineage and initial design to the Pilatus PC-9 although the two aircraft now share almost no common parts. Hawker

Beechcraft made the first combat variant of the T-6A for the Hellenic (Greek) Air Force. It was intended for use as both a COIN and trainer aircraft. The original model could carry ~~-e~~xternal fuel tanks, Mk82 bombs, LAU-68 rocket launchers, BDU-33 practice bombs, and HMP-400 gun pods."[12] The version suggested for the U.S. Air Force will have far more capability:

By adding open architecture avionics, advanced sensors, data link, cockpit and aircraft self protection components, and various weapons capabilities to the already proven T-6A training platform, the Beechcraft AT-6B promises to provide multi-mission capability on a relatively low-cost platform.[13] The AT-6B avionics system uses two modular mission computers to control weapons deliveries and other mission related functions. Integrated navigation and mission data is displayed on a large, 25° Head-Up Display (HUD) and on three high fidelity, color, 5in x 7in multifunction displays (MFD).[14] The AT-6B may also be equipped with a helmet Mounted Cueing System similar to that found on the F-16 or F-15E. The Hands on Throttle and Stick (HOTAS) functionality is similar to that found in the most advanced legacy fighters.[15] All of the AT-6B's displays and interior cockpit components are compatible for use with Night Vision Goggles. The aircraft is also equipped with UHF, VHF, and SATCOM communications systems in addition to Enhanced Position Location and Reporting System (EPLARS), Joint Tactical Information Distribution System (JTIDS), Situational Awareness Data Link (SADL), and LINK-16, providing the capability to participate in the net-centric warfare required on today's battlefield.[16]

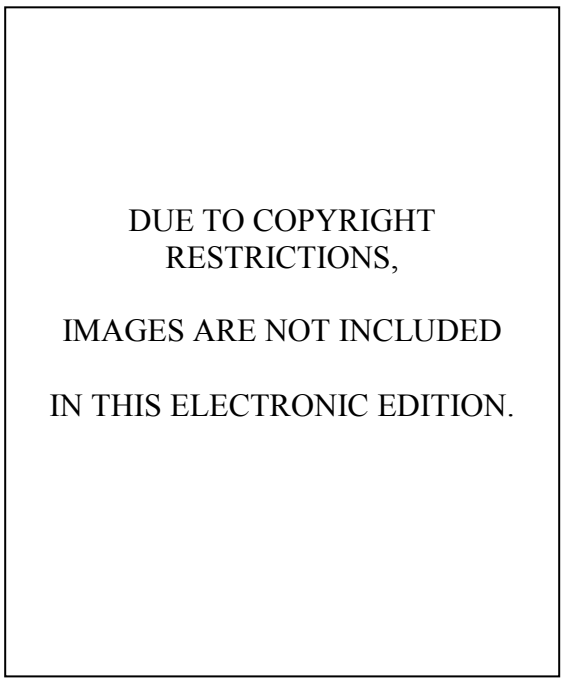


Figure 3. AT-6B Front Cockpit and Displays.
*Source:* Airforce technology.com, *AT-6B Light Attack Aircraft / Trainer, USA*, January 1, 2009, http://www.airforce-technology.com/projects/at-6b-light-attack/ (accessed February 11, 2009).

These systems are all on par with, or superior to, those found on the F-16, F-15E, and A/OA-10 aircraft currently in service with the U.S. Air Force. The AT-6B also carries an impressive electro-optical / infrared sensor suite in the form of the Webcam MX-15di.[17] The MX-15 series is an EO/IR sensor similar in size and shape to those found on many police helicopters. The MX-15 class currently serves on the Air Force Special Operations Command's (AFSOC) MC-130H and MC-130P fleet. The MX-15 selected for AFSOC is a direct "drop-in" replacement for the current Q-17. It provides a multi-Field-of-View digital IR camera and multi-mode video auto-tracker as well as the potential for upgrades including Low Light TV, Eye Safe Laser Rangefinder (ESLRF), laser pointer and image fusion of the IR and LLTV.[18]

The MX-15di scheduled for use on the lightweight ground attack aircraft will come complete with day/night electro-optical sensors, infrared sensors, a laser illuminator, laser rangefinder, and laser designator. This system is smaller and lighter than the SNIPER and LITENING targeting pods typically carried by legacy fighters, but may not have the same coordinate generation accuracy as the larger pods.

The AT-6B also sports a light but versatile weapons payload. The aircraft is equipped with six wing-mounted hard points for carrying external stores. With its MIL-STD 1760 smart weapons interface, the AT-6B can carry a variety of weapons including the FN Herstal HMP 400 50 caliber machine gun pod, air-to-ground missiles including the Hellfire and AGM-65 Maverick, AIM-9 Sidewinder air-to-air missiles, and both guided and unguided air-to-surface munitions including the Paveway II, Paveway IV, Joint Direct Attack Munition (JDAM), Small Diameter Bomb (SDB), and 2.75in rockets.[19]

Despite the variety of weapons available, The AT-6B has a significantly smaller payload capacity than legacy fighter aircraft. This decreased payload capacity is one of the major drawbacks inherent in aircraft like the AT-6B. Although the lightweight ground attack aircraft can loiter for long periods without air-to-air refueling, it cannot haul as much ordnance as legacy fighters. Hawker-Beechcraft stated:

> For the AT-6B, we are incorporating precision guided munitions to include using 250 and 500 pound laser guided bombs, laser guided rockets, and AGM-114 Hellfire missiles. The aircraft is capable of carrying almost 3,000 pounds but the load out for most missions would be in the 1,500 to 2,000 pound range.[20]

As mentioned, the AT-6B will normally carry roughly 2,000 pounds of external stores. With two external fuel tanks to increase loiter time, weapons payload capacity will drop

to 1,000 pounds. In comparison, the F-16 C/D carries 2,000 pounds of ordnance when loaded with 500-pound class munitions and 4,000 pounds when carrying larger 2,000-pound class munitions. The F-15E carries from 6,000 to 10,000 pounds, and the A-10 can carry up to 10,000 pounds of ordnance, during standard combat sorties.

Many lightweight ground attack aircraft including the AT-6B carry the FN Herstal HMP 400 gun pod. When fully loaded the system weighs just over 300 pounds. It utilizes a .50 caliber M3P single barrel machine gun holding 400 rounds of ammunition with an adjustable rate of fire set at just over 1,000 rounds per minute.[21] This rate of fire is six times slower than that of the 20mm M61 cannon carried by most legacy fighters and four times slower than the 30mm GAU-8 carried by the A-10. This rate of fire can be advantageous when strafing troops. The slower rate of fire gives the lightweight ground attack aircraft almost 30 seconds of total strafe time, similar to that of the A-10, whereas the F-16 can exhaust its ammunition in only 5 seconds. FN Herstal asserts the M3P machine gun is effective against troops out to 9,832 feet, and can offer suppressive fire against lightly armored vehicles out to 3,280 feet.[22] In addition, some gun pods can be loaded with a mix of machine gun ammunition and 2.75-inch rockets making them an excellent tool for both CAS and FAC (A) platforms.[23] However, the M3P fails to deliver effects commensurate with those of the GAU-8 or M-61 gun systems found on the A-10 and F-16 respectively.

Figure 4. AT-6B With Stores.
*Source:* Hawker Beechcraft, *Beechcraft AT-6B*, Briefing (Wichita: Hawker Beechcraft, 2008).

## Survivability

Although the AT-6B can operate at altitudes exceeding 30,000 feet mean sea level while in a clean configuration, once external stores are added, the practical operating altitude drops quickly. A combat loaded AT-6B will typically operate from 15,000 to 20,000 feet Mean Sea Level.[24] This lower operating altitude range is a major reason why a lightweight ground attack aircraft will require a permissive air environment in order to maximize its survivability. The anticipated operating altitudes will keep the aircraft clear of most small arms and small caliber anti-aircraft artillery systems, however, it will be susceptible to man portable air defense systems (MANPADS), medium and heavy caliber anti-aircraft artillery, and radar guided surface to air missiles. The AT-6B is equipped

with ceramic armor covering the cockpit and engine area as well as several self-defense systems designed to protect the aircraft from infrared surface-to-air missiles. These self-defense systems include the ALE-47 counter measures dispenser and the AN/AAR-47 missile approach warning system.[25] The AN/AAR-47 provides passive warning against infrared and laser guided missiles fired at its host platform. In addition to providing warning to the aircrew, it cues the ALE-47 onboard expendables dispenser to eject expendable infrared countermeasures in order to defeat incoming missiles. The system includes four sensor units providing 360-degree protection.[26] A processor analyzes the signals received by the sensors, warns the aircrew, and then initiates the countermeasure response.[27] The controller and indicator unit provides warning to the aircrew and allows for manual control of the system. The AN/ALE-47 uses dispense routines tailored to the immediate aircraft and threat environment. Depending on the mode the user selects, the countermeasures may be dispensed automatically, semi-automatically or manually. The associated software consists of the Operational Flight Program (OFP) and the Mission Data File (MDF).[28] The OFP processes threat and aircraft position data to compute the optimum off board response.[29] The MDF contains mission specific parameters used by the OFP and is fully flight line reprogrammable.[30] The ALE-47 countermeasures dispenser is designed to dispense both radar defeating chaff and infrared seeker defeating flares, but due to the absence of a radar-warning receiver (RWR) in aircraft like the AT-6B, chaff is not used.

The ALE-47 is also carried on many legacy fighters currently in the U.S. Air Force inventory. When tied with the AN/AAR-47, it provides excellent countermeasure capability against infrared seeking surface-to-air missile systems. However, this

combination fails to protect the AT-6B pilot during attacks launched by radar guided air defense systems. This is because the aircraft lacks both a radar warning receiver system and electronic countermeasures pod similar to those found in legacy aircraft and designed to defeat radar guided surface-to-air threats. In cases where radar guided air defense systems are present, the lack of an RWR puts the aircraft at a definite disadvantage and is a significant reason the aircraft requires a permissive air environment in order to improve survivability. As a result, the aircraft is far cheaper to purchase and operate when compared to legacy fighters but is less survivable in non-permissive air environments.

Figure 5. F-51 in Korea With CAS Load.
*Source:* Wikipedia, *P-51 Mustang,* April 6, 2009, http://en.wikipedia.org/wiki/P-51_Mustang (accessed April 7, 2009).

Survivability issues have dogged similar ground attack aircraft throughout their storied combat history. During the Korean War, propeller driven aircraft were used for ground attack operations. Although very effective, these aircraft proved less survivable than the high performance jet aircraft that were later introduced into the theater. The F-51 was typical of these propeller driven ground attack aircraft, suffering twice the loss rate of jet aircraft in ground attack missions. Unfortunately, these loss rates were not unique to U.S. Air Force aircraft.[31]

> The Marines showed that they were far better attuned than the USAF to an air war in a Third World country when they arrived in the summer of 1950 with their superb Corsair F-4U piston-engine fighters and fighter bombers. The Corsair (395mph) was also one of the greatest aircraft of the Second World War. As late as 1952 improved versions of the Corsair were still being built, a record for any fighter aircraft. But its loss rate was about the same as that for the F-51.[32]

At first, it may seem these higher loss rates were due to the requirement to descend well within the effective range of the enemy's air defenses in order to accurately deliver ordnance. However, this requirement was common to all tactical aircraft at that time. Nor are the loss rates for propeller driven aircraft unique to the Korean War. During the Vietnam War, the U.S. Air Force lost 403 propeller driven attack and observation aircraft including the A-1, AC-47, AC-130, OV-10, O-1, and O-2 over South Vietnam, Laos, and Cambodia. During the same period, the South Vietnamese Air Force lost an additional 427 propeller driven attack and observation aircraft over South Vietnam. This totaled 830 propeller driven ground attack and observation aircraft lost during the course of the war. Comparatively, the U.S. Air Force lost 467 jet fighter aircraft over the same territory.[33] This trend occurred despite the fact there were far more jet aircraft in theater, flying far more sorties, than their propeller driven counterparts.

There were roughly three times more jet fighters than propeller driven attack and observation aircraft in theater at any given point during the war.


Figure 6. A-1 Skyraider Over South Vietnam.
*Source:* The A-1 Skyraider Association, *Marty Isham Collection,* May 13, 2008, http://skyraider.org/skyassn/otherpics/isham/isham.htm (accessed April 8, 2009).

The survivability advantages enjoyed by jet aircraft can be demonstrated by comparing combat loss rates between Vietnam, Korea, and World War II. During the Vietnam War, the USAF flew more than seven times the sorties it had during Korea, but suffered a loss rate five times lower than that experienced less than twenty years earlier.[34] Also during Vietnam, the U.S. Air Force flew double the sorties the Army Air Forces had in World War II, but sustained less than a tenth as many aircraft losses.[35] The disparity in

survival rates was primarily a result of the jet aircraft's inherent performance advantages including the ability to carry heavier payloads at higher altitudes and airspeeds.

This trend was highlighted in a 1968 memorandum entitled *The Use of Propeller Aircraft and Jet Aircraft in Laos.* In their report to the Secretary of Defense, the Joint Chiefs of Staff reported, "During a ten month period, January 1967--October 1967, the prop loss rate per 1,000 attack sorties in Laos was five times greater than jets."[36] This report coincided with aircraft throughout Laos encountering intense increases in enemy anti-aircraft artillery and small arms fire. The Joint Chiefs summarized by stating, "The particular type of aircraft used, therefore, becomes a trade-off between the ability to survive and the ability to accomplish the mission with maximum effectiveness."[37] Effectiveness was a key issue for the Joint Chiefs because their study noted that although propeller driven aircraft were less survivable than higher performance aircraft, they were also nine times more effective during attack missions at hitting their targets than aircraft like the F-4 Phantom. This increased effectiveness for propeller aircraft was due to the accuracy achieved by using low-altitude tactics and low-altitude diving deliveries. These low altitude deliveries helped increase accuracy by allowing the pilots to positively identify the target while simultaneously reducing both weapon release range and weapon time of flight. This practice helped pilots increase their effectiveness against enemy forces attempting to use favorable terrain for cover. Unfortunately, the low altitude tactics also exposed them to disproportionate amounts of enemy surface-to-air fire. Modern laser and Global Positioning System (GPS) guided munitions have since negated the advantages inherent in low altitude attacks. However, when strafing, lightweight ground

attack aircraft will be forced to assume similar risks and descend into the effective range for small arms, small caliber anti-aircraft artillery, and MANPADS.

The AT-6B can avoid suffering the loss rates experienced by propeller driven aircraft in past conflicts by relying on modern tactics and equipment. Unlike the A-1, or OV-10, the lightweight ground attack aircraft will optimize the use of its advanced weapons, sensors, and communications gear to fly in the 15,000 to 25,000 MSL altitude block. Medium altitude operations will keep it outside the effective range of most anti-aircraft defenses present in a COIN environment. In addition, the AT-6B should be able to achieve survival rates commensurate with those experienced by the aircraft flown in Task Force ODIN (Observe, Detect, Identify, and Neutralize) by operating almost exclusively in permissive air environments.

Task Force ODIN is a good example of how matching mission specialized aircraft to the appropriate operating environment can influence survivability. Task Force ODIN was activated in Iraq in 2007 in order to provide ISR assets to US Army commanders and enable them to better detect and act against insurgent forces.[38] Task Force ODIN operates a mix of aircraft including the Beechcraft C-12 Huron and several other manned, and unmanned, aerial systems. Of these aircraft, the C-12 Huron is most representative of an airframe like the lightweight ground attack fighter. Task force ODIN has supported ground forces across Iraq including those conducting operations during the recent ―surge" campaign. Although often flying much lower than the operating altitudes anticipated for the lightweight ground attack aircraft, Task Force ODIN has not lost a single manned aircraft to enemy action. Therefore, assuming it either capitalizes on medium altitude tactics in order to enhance survivability or operates exclusively in a permissive air

environment, the lightweight ground attack aircraft should enjoy survivability rates on par with those of legacy fighters.

Figure 7. U.S. Army C-12 Huron.
*Source:* Global Security.org, *C-12 Huron Pictures,* April 24, 2005, http://www.globalsecurity.org/military/systems/aircraft/c-12-gallery.htm (April 7, 2009).

## Peacetime Roles and Missions

In addition to COIN operations and low intensity conflict, the lightweight ground attack aircraft is also suitable for homeland defense missions within the United States and her territories. Many proponents of the lightweight ground attack aircraft laud its capability to perform infrastructure protection, border and port security operations,

counter narcotics, disaster area imagery, search and rescue, and command and control (C2) operations. Some of these missions are now performed by Unmanned Aerial Vehicles (UAV) or less capable manned aircraft. However, despite the broad potential for using UAVs in civilian operations, the use of UAVs is tightly restricted in the United States. Currently, UAVs operate in airspace zones known as Restricted Areas that are blocked from use by normal traffic.[39] This practice ensures UAVs avoid mid-air collisions with piloted aircraft. Manned platforms, like the AT-6B, can operate outside these Restricted Areas while performing counter drug, Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), border security, and port security missions. The AT-6B is well suited for the United States Northern Command's arsenal.

In addition to the aforementioned list of homeland security missions, the AT-6B is also well suited for Joint Terminal Attack Controller (JTAC) training. A JTAC is a service member from any branch of the military qualified and certified to conduct terminal control of close air support. Army reorganization and COIN operations in Iraq and Afghanistan have created an ever-increasing need for current and qualified JTACs. During combat operations, Joint Task Force Commanders and Army leaders identified the need for JTACs at the company and even platoon level.

> During Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF), air and ground commanders realized the need for these controllers to train and fight jointly to achieve tactical objectives. Dependent upon Air Force controllers by inter-service agreement, several Army ground unit commanders said they did not have enough JTACs to conduct terminal attack control in support of their forces. In recent months, the Army has established the requirement for JTACs down to the company level vice the task force level now resourced by the Air Force.[40]

As early as 2004, the U.S. Army's Office of the Deputy Chief of Staff (G-3) identified the need for more JTACs due to increased worldwide combat operations and the U.S. Army's reorganization into Brigade Combat Teams. According to the G-3, "Lessons learned in combat established a need to have at least one person per conventional maneuver company qualified and certified to control CAS."[41] In addition, "Total Army requirements for the mid-to-long term (2-5 years) are approximately 20% higher due to projected modifications in force structure to increase field maneuver units."[42] This projected need for more JTACs has since been realized. The current JTAC requirement stands at 871 active duty JTACs for fiscal year 2009 and is projected to grow to 955 active duty JTACs, 333 Air National Guard (ANG) JTACs, and 100 AFSOC JTACs by fiscal year 2012.[43] This is a total fiscal year 2012 requirement of 1388 JTACs. Each JTAC requires 12 controls for initial qualification and 10 controls per year to maintain currency.

> A control consists of at least one aircraft attacking a surface target. The control begins with a CAS briefing (the 9-Line JP-09.3 standard) from a JTAC and ends with either an actual or simulated release or an abort on the final attack run. No more than two controls can be counted per CAS briefing per target.[44]
>
> During initial certification training, candidates must conduct a minimum of 12 fixed-wing Type 1 or Type 2 controls. Four of these controls must expend live or training ordnance. One of the 12 controls must be conducted at night.[45]

Unfortunately for the Air Force, there are currently only 519 combat mission ready JTACs on active duty or serving in the Air National Guard.[46] The shortfall for 2008 was 666 JTACs. In order to maintain just the 2008 level, training sources must produce at least 140-150 JTACs per year.[47] In order to grow the force to over 1100 JTACs, training sources will have to graduate approximately 250 active duty and ANG JTACs per year.[48]

The lightweight ground attack aircraft is an economical option for fulfilling JTAC training requirements. The 250 JTACs slated for training will require approximately 3,000 controls or 1,500 sorties just to finish their qualification course.[49] If the number of controls needed to maintain the currency of the additional 1,388 qualified JTACs required in fiscal year 2012 is considered, the number rises to a total 13,880 controls per year. Assuming a lightweight ground attack aircraft and JTAC can complete four controls per sortie with each control lasting approximately 15 minutes plus an additional hour of flight time added to account for transit to and from the range complex, 8,440 flight hours will be required for JTAC training. However, CAS training flights are normally flown by a pairs of aircraft operating in the roles of flight leader and wingman, therefore the required flight time totals 16,880 hours per year. Assuming JTAC training is supported equally by A-10, F-15E, and F-16 aircraft at an average cost of $8,501 per flight hour, the dollar value for aviation support alone totals $143,496,880. Utilizing lightweight ground attack aircraft operating at $1,500 per flight hour to completely replace legacy airframes will drop costs to $25,320,000 and save the Department of Defense $118,176,880 per year.

However, legacy aircraft do still perform CAS missions in contingency operations and have CAS training requirements. They will undoubtedly participate in JTAC training until their eventual retirement. Therefore, if we assume legacy aircraft will continue to perform at least half of all required JTAC training sorties, the actual savings garnered from using lightweight ground attack aircraft total $59,088,440 per year. This dollar amount approximates the purchase price for six lightweight ground attack aircraft. Consequently, it would take approximately six years to purchase two 18 PAA lightweight

ground attack squadrons totaling 36 aircraft with the savings garnered from JTAC training support.

Currently, any attempt to increase JTAC production remains a difficult proposition at best. There are simply not enough fighter aircraft to support training requirements. This is collectively due to a shrinking fighter inventory, a rapidly aging fleet, and skyrocketing O&S costs. Supporting JTAC training with legacy fighters is prohibitively expensive because supporting aircraft O&S costs exceed the budget for JTAC training. Recently, JTAC training centers began relying on independent contractors operating surplus aircraft to fill the training gap. In the near term, using contractor air support to fill these shortfalls is expected to cost $18 million per year.[50] In addition, contractor aircraft fall short of providing new JTACs the same experience they gain working with active duty or ANG aircraft. Contractor aircraft are not equipped with the targeting pods, data link, communication systems, and avionics standard in U.S. Air Force aircraft. Therefore JTAC training is often limited to antiquated scenarios more appropriate for the Vietnam or Korean War era. This degraded training fails to accurately represent the contemporary operating environment. In addition, U.S. Air Force aircrews lose valuable opportunities to train to the CAS mission in a controlled environment.

The lightweight ground attack fighter is particularly well suited for JTAC training. Since the aircraft is fitted with the same targeting, communications, and weapons systems found on current U.S. fighters, it can provide the detailed, realistic, net-centric training required to properly prepare JTACs for modern integrated warfare. In addition, the aircraft‘s exceptional loiter capability makes it an ideal platform to support

multiple controls without returning to base to refuel. The lightweight ground attack fighter's affordability, maintainability, and proven track record make it ideal for training JTACs in an operationally representative environment.

In an attempt to cut costs and shorten the time required to produce trained JTACs, Army officers close to the issue have offered up simulation as an option for efficiently and economically increasing JTAC production. Although this is probably the cheapest solution, it almost completely eliminates the trust built between the aircrew and JTAC as they practice the detailed integration so crucial in CAS operations. In a report on lingering training issues hampering support of ground forces, the United States General Accounting Office (GAO) stated:

> The success or failure of our military forces in combat is directly linked to the realism and thoroughness of their training beforehand. This axiom is especially true when aircraft are needed to deliver bombs on targets close to troops on the ground. Such close air support requires painstaking coordination between air and ground elements. Timely, well-practiced procedures and communication are essential because close air support on the battlefield often has to happen fast to achieve its objective.[51]

Additionally, the GAO concluded:

> These lingering problems include few opportunities for ground and air forces to train together in a joint environment, a lack of realistic training opportunities at troops' home stations, differences in the training standards for aircraft controllers, and the low priority placed on joint close air support training in the services' school curriculum and exercises.[52]

Given these concerns, the lightweight ground attack aircraft seems an outstanding choice for delivering realistic training to both air and ground forces alike at a reasonable price. In addition, because JTAC training and CAS operations are anticipated to make up the bulk of the lightweight ground attack fighters peacetime mission, aircrew will develop a corporate culture similar to that found in the A-10 community today. When an AT-6B

unit is deployed in support of ground combat operations, the JTACs integrated with ground maneuver units will have a pre-established rapport with the pilots supporting them.

This section has presented the findings of the analysis of both the primary and secondary research questions. The following chapter will present the study's conclusions on the primary research question. In addition, the author will present recommendations for further study concerning the acquisition of a lightweight ground attack aircraft.

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# CHAPTER 5

# CONCLUSIONS AND RECOMMENDATIONS

This study has examined the costs and benefits of fielding a lightweight ground attack aircraft to support air operations in counter insurgency and stability operations. Since 2001, U.S. Air Force legacy fighter aircraft including the F-16 C/D, F-15E, and A-10 have flown combat sorties far exceeding standard peacetime durations during multiple combat deployments to OEF and OIF. These longer sortie durations added significant unanticipated flight time to aging airframes thereby reducing the expected service life of the U.S. Air Force's legacy fighter fleet. Support aircraft including the KC-135 and KC-10 have also accumulated far more hours while supporting combat operations in OEF and OIF than originally planned. In order to preserve a rapidly aging fighter and aerial tanker fleet, the U.S. Air Force must provide effective CAS and ISR support to ground forces while simultaneously lowering flight time and O&S costs for legacy fighters and associated support aircraft. One possible solution is fielding a propeller driven lightweight ground attack aircraft.

## Conclusions

As the U.S. Air Force continues to adjust to tightening budgets and the ever-changing security environment, the temptation to trade combat capability for greater economy will remain strong. Aircraft like the lightweight ground attack fighter offer an economic solution to CAS and ISR requirements in Iraq and Afghanistan. Depending on the terrain and the surface-to-air threat, these aircraft are well suited for these missions. However, the economic advantages gained by operating these aircraft come with a price

tag all their own. This includes reduced combat capability and increased manning requirements. The primary benefit of fielding a lightweight ground attack fighter centers on its ability to lighten the workload of the legacy fleet. This in turn will reduce the total hours flown by legacy fighters and thereby delay their eventual retirement. However, the Air Force and the Department of Defense must resist the temptation to deplete a force capable of ensuring our national survival in order to achieve short-term economic benefits in wars of national interest.

Most of the discussion surrounding the acquisition of a lightweight ground attack aircraft centers on cost, capability, and survivability. Of these three factors, cost and survivability are the most important. In the final analysis, the OA-X concept, as epitomized by the lightweight ground attack aircraft, is the very embodiment of a niche aircraft. It is relatively inexpensive to purchase and operate when compared to the current stable of legacy fighter platforms. The aircraft also has an impressive array of systems that enhance its combat capability, including avionics, sensors, and a large variety of weapons. However, decreased survivability is a risk that must be mitigated. Another drawback of the lightweight ground attack aircraft is that it suffers from a marginal payload capacity and below average aerodynamic performance when compared to legacy aircraft. Fortunately, aircraft like the AT-6B can achieve survivability and reliability rates unmatched by their predecessors of the Vietnam and Korean eras if used in carefully controlled conditions.

Many lightweight ground attack aircraft proponents base their arguments on the potential O&S savings generated by replacing legacy fighter aircraft with aircraft similar to the AT-6B in contingency operations and non-contingency training environments.

There is no doubt that a lightweight ground attack aircraft will be less expensive to operate than legacy fighter platforms. However, the assumptions underpinning cost comparisons deserve close scrutiny. At first glance, direct comparison of the AT-6B to its cousin, the T-6A, seems a reasonable approach for estimating O&S costs. However, the two are far different machines in regard to weapons, sensors, and avionics. Although the AT-6B reduces potential costs by leveraging COTS systems, it will require additional maintenance with no direct correlation to the T-6A. The assumptions for weapons, sensors, and avionics underpinning any manufacturer's estimate for maintaining these systems should be closely scrutinized prior to purchasing an airframe. Currently, the USAF relies on contract maintenance to keep its T-6As flying. The T-6A's status as a trainer ensures it will never deploy to a combat AOR or participate in contingency operations. However, the lightweight ground attack aircraft will undoubtedly deploy, often for long periods, to participate in contingency operations in some of the world's harshest operating environments. Therefore, the U.S. Air Force will be forced to rely on military maintenance, and as a result, absorb higher operating and support costs than those encountered in the T-6A program. This is an area Peeler touched upon in his research. When he discussed how the U.S. Air Force reported costs associated with the T-6A, he stated the following:

> However, one must note that with significant contractor logistics support, some elements are aggregated as contract costs and not disaggregated into the level of detail intended by the Cost Analysis Improvement group (CAIG) structure…the contractor provides maintenance under one all encompassing contract; thus the distinction of intermediate and depot maintenance is lost to the database and estimators trying to delineate costs at such a level.[1]

Although this statement illuminated several pertinent issues, it failed to adequately address the additional costs that will likely result from operating repair facilities to

service items normally sent to the contractor. In addition, the military manpower required to fulfill heretofore contract maintenance positions will inevitably drain critical personnel from other combat systems. All of these factors can significantly affect the overall costs associated with fielding a new aircraft. Although within the realm of possibility, the $1,000 per hour estimated hourly operating cost used by ACC in its calculations seems optimistic. It is possible the actual O&S numbers may not be significantly higher than those quoted by ACC, but maintenance and personnel costs and requirements deserve additional analysis and research.

The costs incurred for O&S are important because they form the basis for most of the savings predictions associated with the lightweight ground attack aircraft. Multiple sources predicted the U.S. Air Force will be able to pay for a small fleet of lightweight ground attack aircraft from just one year‘s savings. These numbers are all based on a cost estimate for the AT-6B of $700 to $1,000 per flight hour. If this predicted O&S cost goes up, or if contingency and training requirements go down, a fleet of lightweight ground attack aircraft will take considerably longer to pay for using annual O&S savings. The facts suggest, however, that paying for a significant lightweight ground attack aircraft purchase in just one year is highly unlikely considering the potential infrastructure and maintenance manning requirements. It is far more likely to take anywhere from five years to a decade to pay off the initial investment incurred from buying 75 to 100 aircraft for both contingency and non-contingency operations. Smaller fleets will be easier to pay for if the operational tempo in contingency operations remains constant.

Additional financial commitment may be required in order to periodically update the lightweight ground attack fighter‘s avionics, sensors, and weapons suites. The computer driven avionics, sensor, communications, and weapons suites required for today‘s net-centric, low collateral damage warfare are very adaptable and offer the ability to add improved capabilities with only minor hardware or software changes throughout the weapon system‘s life cycle. While offering incredible flexibility and adaptability, the capacity to conform to new operational environments comes with a price. The required hardware and software modifications lead to a continuous process of product development, testing, and implementation throughout the weapon system‘s life cycle. Therefore the U.S. Air Force will have to maintain continued investment in any airframe it decides to purchase in order to produce the spiral upgrades that will enable the lightweight ground attack aircraft to adapt to multiple operating environments and remain a viable platform.

The operating environment can dramatically affect the survivability of aircraft like the AT-6B. Lightweight ground attack aircraft may be at a disadvantage in AORs similar to Afghanistan where mountain passes are often situated between 12,000 and 15,000 feet MSL.[2] This is particularly true if the air defense threat includes large caliber anti-aircraft artillery or advanced MANPADS. Regions possessing extremely elevated topography will force propeller driven lightweight ground attack aircraft to operate in the effective range of several systems conceivably available to insurgents in the COIN environment and thereby effectively reduce the area in which these aircraft can successfully operate.

Regardless of the operating environment, it is likely aircraft like the AT-6B will descend into the small arms threat envelope when strafing. At low altitude, the aircraft is at a significant disadvantage compared to legacy fighters primarily because of its slower airspeed and rate of climb during attack recovery. In addition, most lightweight ground attack aircraft lack internally mounted guns, choosing instead to carry gun pods on external stations. Although it offers good capability for the counterinsurgency role, the gun pod accounts for roughly 25 percent to 33 percent of the aircraft's available weapon payload when carrying external fuel tanks and limits the amount of air-to-surface munitions available. This could prove particularly disadvantageous in cases such as a ~~"t~~troops in contact" situation requiring persistent fire. Despite their ability to remain survivable in COIN operations, the lightweight ground attack aircraft's slow speed and rate of climb, lower service ceilings, and decreased payload capacity will remain a liability and occasionally counter the benefits derived from improved economy and flexibility.

It is doubtful aircraft like the AT-6B will ever completely replace legacy fighters in contingency and non-contingency environments. Manufacturers can easily outfit lightweight ground attack aircraft with the same avionics, weapons, and data link combinations found in today's most advanced tactical aircraft. However, performance and payload are another matter. Although aircraft like the AT-6B have excellent reliability and in-flight endurance, they cannot match the speed, altitude, payload, rate of climb, and sustained turn performance inherent in most jet powered aircraft. Fortunately, the AT-6B can utilize modern tactics and technology to overcome weaknesses that proved deadly to its progenitors in earlier conflicts. These include medium altitude

deliveries, advanced sensors, and GPS or Laser Guided smart munitions. Aircraft like the AT-6B will also be able to deliver ordnance from altitudes in excess of 20,000 Mean Sea Level (MSL) allowing them to keep clear of most small arms, small caliber anti-aircraft artillery, and MANPADS with little to no degradation in weapon effectiveness. However, the dangers inherent in performing strafe attacks remain a concern. In addition, radar guided air defense systems will negate the lightweight ground attack aircraft's defensive suite. Therefore, it is far more likely that legacy aircraft and lightweight ground attack aircraft will operate side by side in COIN operations and low intensity conflicts. As a result, planners should avoid the tendency to think of the lightweight ground attack aircraft as an all or nothing solution for CAS, ISR, and JTAC training support. In addition, legacy platforms will still experience benefits derived from reduced operating tempos as lightweight ground attack aircraft shoulder significant portions of both the contingency and JTAC training workloads.

Lightweight ground attack aircraft have the potential to shine in peacetime operations. Although somewhat expensive for a trainer, they are far cheaper to purchase and operate than the legacy aircraft they would supplement in JTAC training. In addition, a unique mix of endurance, advanced avionics, improved communications, and diverse weapons configurations makes the lightweight ground attack aircraft ideal for JTAC, CAS, and FAC(A) training, In addition to providing a representative combat platform at a fraction of current costs, two-seat aircraft like the AT-6B are also very well suited to other peacetime roles including counter drug, C4ISR, border security, and port security.[3] These roles will round out the declared operational capabilities of a lightweight ground attack aircraft wing based in the United States.

## Recommendations

The author recommends further study in order to determine the personnel requirements for using military manpower to perform operations and maintenance functions in a lightweight ground attack aircraft combat squadron. This additional research should examine how this requirement would affect manning across the CAF based on two different scenarios. The first scenario should consider basing the entire lightweight ground attack aircraft fleet in a single Fighter Wing structure. The second scenario should consider placing individual lightweight ground attack aircraft squadrons in existing Fighter Wings in order to augment legacy aircraft. This analysis would contribute to a re-calculation of predicted O&S costs for an aircraft like the AT-6B. Finally, the author recommends accomplishing detailed cost analysis studies using best and worst case cost comparisons in order to obtain a clear picture of the possible economic risks associated with purchasing these aircraft.

Depending on the outcome of the subsequent studies, the author recommends purchasing 75 to 100 lightweight ground attack aircraft for use in JTAC training, COIN operations, and low intensity conflicts. The author also recommends the aircraft primarily utilize medium altitude tactics in permissive air environments.

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