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Developing a low technology CAS asset for COIN operations can optimize the U.S. armed forces and allow the air component of the military to provide effective and efficient CAS in COIN.
As the United States armed forces continue to deal with irregular and insurgent threats, employing a low-tech aircraft in CAS in COIN is the future for the air components of the U.S. armed services. Developing and fielding a turboprop aircraft for CAS in COIN will provide effective use of airpower in a COIN environment. By providing the effective CAS, this airframe will increase the efficiency of the armed services air components.

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MASTER OF MILITARY STUDIES

AIRPOWER IN COUNTERINSURGENY (COIN) OPERATIONS: CONSIDERATIONS FOR LOW-TECH AIRCRAFT FOR EFFCITVE CLOSE AIR SUPPORT IN COIN

SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF MILITARY STUDIES

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Executive Summary

Title: Airpower in Counterinsurgency (COIN) Operations: Considerations for Low-Tech Aircraft for Effective Close Air Support in COIN.

Author: Major Peter G. Herrmann, United States Marine Corps

Thesis: Developing a low technology CAS asset for COIN operations can optimize the U.S. armed forces and allow the air component of the military to provide effective and efficient CAS in COIN.

Discussion: The United States armed forces continue to operate in a COIN environment which employing CAS in support of COIN operations. The military needs to optimize its equipment, capabilities, and tactics to be successful in the COIN environment. History has shown the success of low-tech assets in past COIN operations. With potential defense budget cuts, and a call to become more efficient in operations, the armed services need to evaluate how they operate. By introducing a light attack armed reconnaissance (LAAR) aircraft such as: OV-10X, *Super Bronco*; Embraer, *Super Tucano*; Hawker-Beechcraft, *AT-6*; Air Tractor, *AT-802U*; or Pilatus, *PC-9M,* into the CAS role for COIN, the military can provide effective and efficient CAS. This will reduce the cost of lives and save money.

A low-tech turboprop aircraft can provide the same types of CAS coverage as current high-tech jet aircraft, but have enhanced mission capability. Their increase in flight time per fuel used makes them more economically efficient. Low-tech assets, such as the LAAR aircraft concept, have the ability to operate in austere environments, with a small logistical footprint. With the ability to increase flight time, decrease fuel requirements, reduce the footprint, and having the capability to operate near the forward line of troops will increase the efficiency of the CAS platform.

The design considerations for the LAAR aircraft will provide same firepower and intelligence surveillance reconnaissance capabilities as today's high-tech jet aircraft. LAAR aircraft will have the ability to bring the same assets to the battlefield, and continue to maintain that asymmetrical threat to the enemy for which the ground commander is looking. With the increase in loiter time and the dual cockpit design, situational awareness of a LAAR aircraft aircrew will thus be enhanced, thus increasing the effectiveness of the aircrew and thus increasing the efficiency.

Conclusion: As the United States armed forces continue to deal with irregular and insurgent threats, employing a low-tech aircraft in CAS in COIN is the future for the air components of the U.S. armed services. Developing and fielding a turboprop aircraft for CAS in COIN will provide effective use of airpower in a COIN environment. By providing the effective CAS, this airframe will increase the efficiency of the armed services air components.

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Preface

Since April 2002, I have been designated a Marine Utility Helicopter Pilot and have flown the UH-1N, Huey. Since 2002 to 2009, I have flown Close Air Support (CAS) in Operations Iraqi Freedom and Operation Enduring Freedom. I have also served as a Forward Air Controller in Operation Iraqi Freedom. I have witnessed the need for and complexity of CAS in the Counterinsurgency (COIN) environment. I feel that CAS has become an essential supporting requirement for ground forces conducting COIN operations. CAS aircraft have become the essential "eyes and ears" for forces that are rooting out insurgents on today's battlefield.

I started this research endeavor by looking at how the Armed Forces, the Marine Corps specifically, could implement aviation in COIN. As I began to scratch the surface assessing efficient use of airpower in COIN, I determined that airpower in COIN is a large and vast topic, too big to cover in twenty pages. As FM 3-24 *Counterinsurgency* states, airpower is an asymmetrical asset, with many facets. That is when I started to concentrate on something that was near and dear to me, CAS, specifically CAS in COIN. I wondered if there was anything that the air component could do to ensure CAS in COIN is more effective for the ground units while also efficient to meet the budget constraints of today and tomorrow.

This paper will discuss the history of airpower in COIN and briefly look at what worked in the past, and how we can apply lessons learned to today's battlefield. It will explain how CAS is an essential requirement for COIN. It will also assess the need to field an airframe to meet the needs of the COIN environment, while taking into account Department of Defense budgetary issues. It will take into consideration FM 3-24, *Counterinsurgency*, specifically Airpower Appendix E. Using the topics of FM 3-24, Appendix E, this paper will examine those that apply to CAS in COIN, and what the air component of the U.S. armed forces need to be able to conduct. This paper will discuss how the air components of the U.S. Armed Services can meet the capability requirements for COIN, and

look at a low-tech option for being efficient and effective at employing and advising CAS in COIN. It will discuss how to apply those considerations to the employment of effective CAS and to maximize CAS assets.

CAS will be assessed from the perspective of the operator and the customer, the infantryman on the ground. This paper will not be a tactical publication, and will not discuss new tactics techniques, or procedures for CAS employment. It will discuss CAS in theory and I hope will stimulate additional discussion of the issues that come with the use of Airpower in COIN. I hope to look at these issues, as well as see what the future holds for CAS in the future.

First, I would like to thank Dr. Donald F. Bittner for his tutelage. You have helped me go down those paths that I never would have thought of going. You have given me a different perspective on how to look at history, asking different question. Your wealth of knowledge, in and out of the class, has been invaluable.

Lastly, I would like to thank my family. I am so grateful for the sacrifices that have been made while I have spent researching and writing on this topic. The long days and long nights that I have spent have enriched me as a Marine officer, and Marine aviator. I am grateful and humbled for the time the Chris has spent taking care of Miles and Abby, while I have been away from home. Through thick and thin, my family has always been there for me as my foundation. Thank you!

In this type of war you cannot - you must not – measure the effectiveness of the effort by the number of bridges destroyed, buildings damaged, vehicles burned, or any of the other standards that have been used for regular warfare. The task is to destroy the effectiveness of the insurgent's efforts and his ability to use the population for his own ends.

General Curtis Lemay, USAF[1]

Introduction

"Airpower has long been a critical, if somewhat controversial, element of counterinsurgency operations…the central elements of airpower-flexibility and versatility-make it uniquely suited for counterinsurgency."[2] Currently, the United States is actively involved in the Global War on Terrorism, engaging in a combination of conventional and unconventional counterinsurgency operations. Since the attacks on the American homeland occurred on September 11, 2001, the armed forces of the United States have been involved in operations in Iraq, Afghanistan, and in Libya. The current fight has all the possibilities of being a very long one. Even though the United States has been dealing with conventional warfare, as with Operation Iraqi Freedom I, the majority of operations have been counterinsurgency (COIN) as in Afghanistan. As these continue in Afghanistan, involvement in COIN operations will continue well into the foreseeable future; therefore the armed forces must optimize its capabilities, equipment, and tactics in order to be successful in the COIN environment. This optimization must also take into account the current and future economic constraints of the United States, and develop and equip a force that is effective as well as efficient (to include costs). To achieve this, the United States Air Force has the lead in developing overall strategies for Airpower in COIN that all armed services can follow.

Close Air Support (CAS) in COIN has seen a surge in recent years in Iraq and Afghanistan. There has been an increase in the need for strike aircraft to supply CAS to troops on

the ground. As the U.S. continues to operate in a COIN environment, new challenges have developed for the Forward Air Controller (FAC) and Joint Terminal Attack Controllers (JTAC). It has become difficult for pilots to get good eyes on potential targets, not because of lack of talent or training but due to the complexities of COIN operations. Modern Fix Wing (FW) aircraft operate at high airspeeds with an attendant high fuel burn rate. This causes them to have difficulties of getting eyes on the target in their limited time on station inherent in such aircraft. One solution to providing effective and efficient CAS is a return to the use of propeller driven aircraft, such as the USAF's light attack armed reconnaissance (LAAR) program.

Almost as soon as the airplane was developed, it assumed an important role in warfare against irregular forces.[3] Aviation has provided commanders that particular capability that can give them an asymmetrical advantage on the battlefield against irregular forces. Aircraft have continued to evolve from the first airplane, to the helicopter, and finally to the unmanned aircraft, all of which are used on the battlefield today. Airpower has become a vital asset in a COIN environment, and an important force multiplier for U.S., multinational, and host-nation (HN) forces.[4] As the United States continues to be involved in COIN operations, the use of airpower needs to be evaluated. Reevaluating airpower's use in COIN needs to be done in order to ensure that an effective and efficient fleet, especially for close air support (CAS), is maintained and meeting the intent of COIN operations and the needs of U.S., coalition, and host nation forces. The Air Force is the lead service, but all services should man and develop the right fleet to meet the intent of Field Manual No. 3-34 / Marine Corps Warfighting Publication No.3-33.5 "*Counterinsurgency*" (FM 3-24/MCWP 3-33.5) and Air Force Doctrine Document 2-3 "*Irregular Warfare*" (AFDD 2-3).

Secretary of Defense, Robert Gates stated that the Quadrennial Defense Review (QDR) released in February 2010: "...represents an important step toward fully institutionalizing the ongoing reform and reshaping of America's military-shifts that rebalance the urgent demands of today and the most likely and lethal threats of the future."[5] Secretary Gates implies that the Department of Defense (DoD) needs to learn from the lessons and experiences from the wars in Iraq and Afghanistan, and continue to develop an armed service that is prepared for the broad range of security challenges in the future. The United States military needs to have a broad arsenal to conduct the many missions that it may face. In the QDR, the plan is laid out for the future of the air components of the nation's Army, Navy, Marine Corps, and the Air Force. With regards to Counterinsurgency Operations, the QDR calls for: (1) an expansion of aircraft, manned and unmanned, for intelligence, surveillance, and reconnaissance (ISR); (2) increase of the fleet of aircraft that are suited for training and advising partner and host nation air forces; and (3) the U.S. Air Force to field a light mobility and light attack aircraft to meet the needs of the counterinsurgency environment. The latter includes lighter fix-wing aircraft to assist the Air Force's 6th Special Operations Squadron training and equipping of host and partner nation air forces.[6] Lastly, the Secretary of Defense challenged the DoD and stated that it must, "...reform the way it does business."[7]

Background

The French may have been the first country to use airpower in a small wars environment in Algiers in 1913,[8] and the U.S. Army had the distinction of being the first American armed service to use airpower. However, it was the United States Marine Corps that first seriously utilized airpower in a small war setting.[9] On 27 February 1919, Marine aviation received its small wars baptism in the Dominican Republic,[10] but it was the experience of Marine Corps

aviation in the Second Nicaraguan Campaign in 1927-1928 that developed and defined air operations in COIN. Marine aviators believed that airpower could play a significant, if not a decisive, role in fighting guerrillas and other irregulars.[11] Being such a successful force multiplier, several of the Marine aviators who served in Nicaragua participated in the effort of writing of the United States Marine Corps' *Small Wars Manual,* devoting an entire chapter to aviation.[12] General Vernon McGee wrote: "It may be said that Marine Corps aviation came of age during the Nicaraguan campaign. The lessons learned were incorporated in the training manuals later concocted for the guidance of a younger generation...the doctrine of close air support was refined to an exact science..."[13]

Current counterinsurgency doctrine for the U.S. Armed Services includes Joint Publication 3-24 (JP 3-24), *Counterinsurgency* and U.S. Army Field Manual No. 3-24/ Marine Corps Warfighting Publication No. 3-33.5 (FM 3-24/MCWP 3-33.5), *Counterinsurgency.* Both documents are similar while addressing issues with regard to Counterinsurgency operations. FM 3-24/MCWP 3-33.5 was published in 2006 and JP 3-24 was published in 2009. Until FM 3-24 was published, 20 years had lapsed since the Army had written U.S. Army Field Manual 90-8: *Counterguerilla Operations*, and 26 years since the Marine Corps had republished its guide to counterinsurgency, the Corps' own *Small Wars Manual, 1940.*[14] There became a strong need for an updated publication for counterinsurgency.

Due to the wars in Iraq and Afghanistan, the United States found itself in a position that it had not been in since the Vietnam War. Some prominent military analysts feel that armed forces had forgotten the lessons learned fighting an insurgency in Vietnam while COIN had been relegated to U.S. Army Special Forces. The U.S. Army and the U.S. Marine Corps changed their focuses after Vietnam towards the potential fight with the Soviet Union. Hence, even the writers

of FM 3-24 commented, "...the Army had purged itself of everything that had to do with the irregular warfare of the Vietnam War, because it had everything to do with how the Army had lost in Vietnam."[15] FM 3-24/MCWP 3-33.5 is a relatively new field manual although its concepts are not. Still, because of its relative newness, the tactics, techniques, and procedures, need to be implemented while they are discussed and refined at all levels.

On 1 August 2007, the Air Force released Air Force Doctrine Document 2-3 (AFDD 2-3), *Irregular Warfare*. The need for the Air Force to develop its own doctrine occurred after FM 3-24 appeared. Many in the leadership of the Air Force felt that they had been relegated to an appendix.[16] AFDD 2-3 is the Air Force's doctrine that takes the Airpower Appendix E in FM 3-24 / MCWP 3-33.5 to a new level, addressing specifics of airpower's role in Irregular Warfare. What has remained constant in the two publications is the feeling that "[A]irpower...produces asymmetrical advantages that can be leveraged by the joint force commander in virtually every aspect of irregular warfare."[17] AFDD 2-3 thus establishes operational-level doctrinal guidance for irregular warfare.[18] Its doctrinal guidance can be applied to all services when ~~to the~~ using airpower in COIN.

Appendix E of FM 3-24 / MCWP 3-33.5 deals with Airpower. The key take away from this section is how Airpower is a supporting effort for the ground force, the main effort. Airpower both serves as a significant force multiplier and enables counterinsurgents to operate more effectively.[19] In this section, Airpower is broken down into eight elements: (1) airpower in a strike role, (2) airpower in intelligence collection, (3) air and space information operations, (4) high-technology assets, (5) low-technology assets, (6) airlift, (7) the airpower command structure, and (8) building host-nation airpower capability. An argument can be made for one aircraft that can fill the need for, airpower in a strike role, low-technology assets, and building

host-nation airpower capability. Concentrating on these three areas, with CAS as a subset of strike, a light turbo-prop aircraft could fill these elements. The armed services could utilize this aircraft to meet requirements to have a cost effective platform that could provide CAS and could also be used in building host-nation's air capability.

Considering that airpower in a strike role can also be redefined as air strikes, close air support (CAS) can be considered a form of airpower in a strike role. Thus, using the definition of an air strike, as defined by Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, it is as "an attack on specific objectives by fighter, bomber, or attack aircraft on an offensive mission."[20] Joint Publication 3-09.3, *Joint Tactics, Techniques, and Procedures for Close Air Support (CAS)*, defines CAS as: "...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."[21]According to the JP 3-24, *Counterinsurgency*, CAS is a capability that the air component of the joint force command must perform, and is one that host-nation airpower must also possess, in order for effective COIN operations to be conducted. Both JP 3-24 and FM 3-24 warn that care must be taken when conducting CAS so as to minimize or eliminate collateral damage. If the later occurs, such action can be used against the counterinsurgent.

Problem Discussion

War amongst the people is different: it is the reality in which the people in the streets and houses and fields-all the people, anywhere-are the battlefield. Military engagements can take place anywhere: in the presence of civilians, against civilians, in defence of civilians. Civilians are the targets, objectives to be won, as much as an opposing force.

General Rupert Smith, *The Utility of Force*[22]

As the trend noted by General Smith continues, commanders and general officers have to enforce stricter constraints on the use of CAS. Due to the rules of engagement (ROE), this will

reduce the window of opportunity to provide effective CAS to the ground combat element (GCE) in COIN. The complexities of conducting COIN, as General Smith would call "A war amongst the people", constrains aircrew from conducting indiscriminate CAS. This is in contrast to operating in a conventional battle field, where there is a "secluded battlefield upon which armies engage in battle"[23] in which the battle lines are drawn and defined. The ability to provide effective CAS for the GCE becomes more constricted in COIN. For example, with the scrutiny that is placed on the use of strike aircraft, pilots and Joint Terminal Attack Controllers (JTAC) spend more time obtaining the authority to employ CAS in a COIN environment such as in Afghanistan. After an air strike hit a residential compound in 2009, General Stanley McChrystal, Commander, International Security Assistance Force (ISAF), addressed this issue when he stated that "air power contains the seeds of our own destruction."[24] Civilian casualties and collateral damage in Afghanistan has led to a 15-step process for employing CAS with its multiple layers of approval authorization. This has increased the time, sometimes an hour or more, from troops in contact (TIC) to an effective air strike.[25] The aircraft may reach BINGO, or low fuel level, and have to return to base not being able to support the troops that were in contact. Rand conducted a study of insurgency and COIN and found that, "Often, precision strike will have to be conducted within tight time frames, because in many situations targets will be fleeing, thus requiring short sensor-decider-shooter timelines."[26] What is the solution to this dilemma?

In after action reports (AAR) two Marine battalions made comments on issues with CAS support while operating in Afghanistan. 1st Battalion, 6th Marine Regiment (1/6) and 2d Battalion, 6th Marine Regiment (2/6) both operated in Marjah in the Helmand Province, Afghanistan. They noted deficiencies in support that they received from air, either with delays in responsiveness or deconfliction of air, clearance of fires, or coordination of CAS. 1/6 noted that

the FSCC (Fire Support Coordination Center) was slow in clearing fires as a result of the constant alterations in the original fire support plan.[27] Ensuring targets were free and clear of potential civilians delayed and reduced the effectiveness of employing CAS, especially when dealing with IED emplacers. In order to gain a positive identification of enemy combatants or IED emplacers, JTACs would use ISR platforms to confirm targets. In some instances, however, armed ISR platforms were employed to target enemy forces when the controlling JTAC did not have a solid feed from the ISR platform.[28]

Gaining clearance to prosecute the target may be lost due to the lack of visually identifying the target, inability to clear the area of civilians, or a of lack of clearly seeing the target area due to the poor downlink. In 2/6's AAR, it noted issues with delays in response time, delays in airspace deconfliction, lack of qualified JTACs and JFOs, and ineffective target marking for CAS. With delays taking "...upwards of 30 minutes for platforms to check on-station..." and the "...deconfliction (of airspace) process usually taking 5-10 minutes..."[29] resulted in missed opportunities and ineffective use of CAS platforms. 2/6 also noted that "...it did not have enough JTACs and JFOs to patrol with every unit that departs friendly lines...,"[30] which reduced the abilities of units to effectively conduct CAS. Lastly, 2/6 pointed out that it took a long time to get aircraft to visually spot the target because of issues with marking the target: "The majority of patrolling efforts take place during daylight hours, which limits the number of effective marks."[31] The AARs from 1/6 and 2/6 highlight the difficulties that they had with employing effective CAS during their time in Helmand.

Even with precision munitions, collateral damage and civilian casualties occur during air strikes. Being able to see, acquire, and have situational awareness of a target can alleviate collateral damage and civilian casualties. To be able to loiter and fly at lower altitudes, to have

eyes on the target, and work out de-confliction with the JTAC on the ground would give the aircrew the necessary increase in situational awareness (SA). If an aircraft had the capability to loiter in the objective area for a longer period of time, the pilots' situational awareness (SA) of what is occurring would be constant. Once clearance is given to employ CAS and having the same aircrew overhead, target acquisition time would be minimal. The end result: helping the air ground team to increase the effectiveness of target prosecution. With an increase in SA, aircrew can make the adjustments necessary to alleviate potential collateral damage. In a 2008 interview for *National Defense,* military analyst and author of '*Winning the Un-War: A New Strategy for the War on Terrorism,"* Charles V. Pena stated, "It doesn't matter how accurate they are when you are dropping ordnance at high altitude when pilots can't see the ground, there is collateral damage."[32]

Some lessons learned from Afghanistan found that "the enemy relied on concealment...only massing immediately prior to an attack, thereby creating fleeting opportunities for engagement."[33] Because insurgents are naturally adapting to our tactics and techniques, it is becoming harder to positively identify them, "...in terms of attacking the enemy, the greatest challenge was identifying insurgents with enough certainty that they could be engaged."[34]The insurgent is always adapting because he is a living force, just like the counterinsurgent. Clausewitz pointed out that war is an interaction between two living and interactive, and adaptive, forces. Therefore your enemy is adapting to defeat you.[35] To counter this, the situational awareness of pilots can be increased by having the ability to see the target due to lower altitudes and longer loiter times. This will combat any ability of the enemy to adapt and thus increasing the effectiveness of CAS.

Air-Ground Team

Today's COIN battlespace can be a complex integration of air, ground, and indirect assets. With the potential of fire support coordination measures (FSCM) being less defined in COIN due to the ever changing and fluidity of the environment, deconfliction can become an issue. The airspace in the objective area may have a multitude of manned and unmanned aircraft. Airpower is an asset for the U.S., multinational, and host nation (HN) ground forces, especially in strike, reconnaissance, and air transport. Controlling aircraft and indirect fires can become a taxing feat for Air Officers (AirO), Forward Air Controllers (FAC), and Joint Terminal Attack Controllers (JTAC) on the ground. All three members are part of the Tactical Air Control Party (TACP), who liaises with ground forces, providing aviation support. Forward Air Controllers Airborne (FAC(A) are extensions of the FAC and are an asset to the TACP. Tactical Air Coordinator Airborne (TAC(A)) and Assault Support Coordinator Airborne (ASC(A)) can assist the Direct Air Support Center (DASC) and be an asset that can control aircraft in the objective area. Potentially having an aircraft with either a FAC(A), TAC(A), or ASC(A), can help the DASC and TACP. Aircraft with these capabilities can help increase the deconfliction and control of the flow of aircraft, attack and assault support, into and out of the objective area, and increase the SA of all agencies. This will increase the effectiveness of utilization of all aircraft in the objective area.

Providing these capabilities to the TACP helps the TACP deconflict the airspace, and gives everyone an increase in SA. This increase in SA assists the TACP with implementing aircraft in either helicopterborne operations or conducting air strikes on targets. As extensions of the TACP and DASC, the AirO and DASC can use all three of these assets to their advantage. This increase in coordination will help in the reduction of possible fratricide, collateral damage,

and civilian casualties. The potential employment for FAC(A) still remains even though the probability of employment is low in today's environment.[36] The figures below show relationship of all agencies within the Marine Air Command and Control System (MACCS).

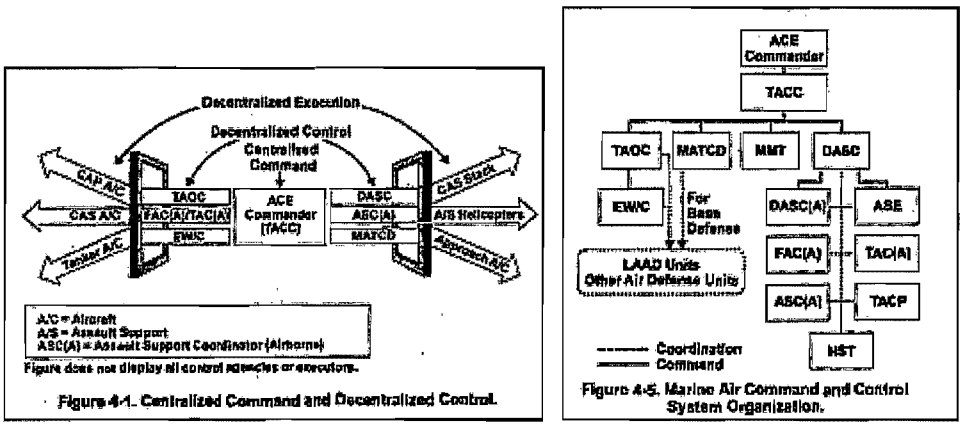

Fig. 1: Air Combat Element Command and Control Structure

Air operations that are conducted in a COIN environment will have to operate from forward operating bases (FOB) that are close to the forward line of troops (FLOT), Many times, these FOBs are very austere with small unprepared runways. Hence they require a rugged and short takeoff platform. FOB Dwyer, in Afghanistan, is an example of the types of airfields that aviation planners will have to contend with. At 3,000 feet in length initially, FOB Dwyer's runway was able to accommodate all the Marine Expeditionary Brigade's aviation assets, including the AV-8B Harriers.[37] With the proximity to the FLOT, these FOBs will be susceptible to attack from enemy direct and indirect fire. In 2005, a rocket attack destroyed one British Harrier and damaged another while they sat on the ramp in Kandahar, Afghanistan.[38] As aircraft become more advance, they become more expensive and hence almost a national asset. Putting these aircraft in an area that is susceptible to indirect fire could lead to the loss of a high value asset and the enemy knows this. With an estimated unitary cost of USD$122 million, the F-35B would be a national asset, operating out of FOBs susceptible to indirect fire.[39], Currently the F-

35B, the Marine Corps' version of the *Joint Strike Fighter,* is being designed to have the capability to land and take off from airfields like FOB Dwyer's. Finding the balance for an aircraft that can operate effectively from these FOBs and that are not expensive can become a challenge.

Budgetary issues have given cause for concern within the Department of Defense. With a drive to be energy efficient and cost effective, DoD is receiving scrutiny within itself and from other executive agencies and Congress. The 2010 QDR requires that the DoD will fully implement the statutory requirement for energy efficiency set forth in the 2009 National Defense Authorization Act.[40] Using the Marine Corps as an example and according to the MAGTF Planner's Reference Manual, MSTP 5-03, a Marine Expeditionary Force (MEF) uses 1,622,600 gallons of fuel per day. The Aviation Combat Element (ACE) alone uses 1,276,100 gallons per day, representing over 78% of fuel used (2010 numbers).[41] The majority of the fuel used by the ACE is by fixed wing aircraft.

The significant cost and developmental issues of the F-35 has raised concerns. Secretary of Defense Gates announced in a speech that the Marine Corps version of the F-35 Joint Strike Fighter, the F-35B, was on two-year probation - due to problems with the design of the short take off vertical landing (STOVL) capability.[42] Noting the problems of the F-35B, General Amos, the 35th Commandant, continues to reiterate the need for the F-35B: "Despite some minor engineering setbacks, the F-35B Short Take-Off and Vertical Landing (STOVL) Joint Strike Fighter (JSF) remains vital to the Marine Corps' doctrine of conducting expeditionary operations."[43] If the F-35B does not meet all expectations, the Marine Corps will have to find a suitable alternative. Currently the Marine Corps AV-8B, the current STOVL aircraft, is approaching the end of its service life. If the F-35B does not become operational, the Marine

Corps will need to find an aircraft to replace the AV-8B. Offsetting potential airframe deficits, the Navy and Marine Corps decided to increase Marine Corps carrier squadrons, flying the F-35C, "... Marines will contribute five carrier squadrons across the fleet, and increase from today's three." The Corps will reduce the number of F-35Bs to 340 planes and will have 80 F-35C, with this new plan.[44]

The key to airpower is for the U.S. armed services to employ an aircraft that is effective and efficient in a strike role. The measure of effectiveness for this type of aircraft is increasing the capability of the air compliment to conduct precision CAS that is effective in attacking a target while minimizing collateral damage and limiting civilian casualties. At the same time, the air forces should be able to provide a HN with the training and resources to enable them to provide for its own internal and external defense.[45] In Operation Iraqi Freedom (OIF), the United States and Coalition forces provided airpower support for the Security and Stabilization Operation (SASO) phases. These aircraft also flew in support of COIN operations during this timeframe (2003-Present). As Iraq's armed forces are rebuilt, increasingly the responsibility for air support for the COIN operations in Iraq must be handed over to the reborn Iraqi air force. While Iraq's air force takes the lead in this mission, lessons can be drawn from this experience and used for the future of the Afghan air force. Currently U.S. and Coalition forces provide the majority of airpower and air support for operations in Afghanistan. These lessons can be taken into account while refinements are made to the tactics and techniques for future COIN operations. The ultimate intent of Appendix E in FM 3-24 (Appendix C) is building a HN's airpower capability, preparing them to continue the Counterinsurgent fight.

Factors that need to be considered when building a HN's Airpower Capability include: (1) basic capability requirements, (2) organizational model and aviation infrastructure for the

long term, (3) economic and technological resources, (4) time requirements to train a host nation air force, (5) and the need for long term liaison support. When determining an aircraft for the host nation to conduct CAS, considerations should be made to determine if a high-tech or low-tech aircraft would fit these requirements for it. Ultimately, a host nation will make the decision which aircraft it will use. However the U.S. can teach, train, and advise a host nation on the right aircraft to match its needs with appropriate means. In many cases a low-tech approach has proven to be a highly useful and cost-effective means of employing airpower in counterinsurgency and counterterrorism operations.[46]

Proposed Solution

Today's approach of loitering multi-million dollar aircraft and using a system-of-systems procedure for the approval and employment of airpower is not the most effective use of aviation fires in this irregular fight. A Light Attack Armed Reconnaissance (LAAR) aircraft capability has the potential to shift air support from reactive threat response, to a more reactive threat response...

General James N. Mattis, Commander, USJFCOM[47]

On March 9, 2010, General James N. Mattis, USMC Commander, United States Joint Forces Command, testified before the Senate Armed Services Committee. General Mattis reported on what JFCOM was, for what it was responsible, and what his command was currently doing.[48] General Mattis has since left USJFCOM and is the Commander, United States Central Command (USCENTCOM). During his remarks, General Mattis explained how JFCOM was planning for today's fight and that of the future, and how the nation will prevail. He talked about how JFCOM was taking a balanced approach for the training and equipping of today's service members, but currently the services are engaged in an Irregular Warfare (IW) operations, while training and equipment advances are continuing to happen. Also, he discussed how the use of

current aviation platforms may not be the most effective use of multi-million dollar aircraft in this type of irregular fight.

Significantly, General Mattis endorsed the Navy and Air Force's joint project, Light Attack Armed Reconnaissance (LAAR) aircraft and its inherent capabilities. General Mattis addressed the needs of all branches of the armed services with regard to what is still needed for today's fight. He stated that airpower in Afghanistan represents one of a joint force's greatest asymmetric advantage over the enemy. He went on to state the lethality and detriment strike airpower had and has over an enemy in this IW environment, hence it is a key asset to the ground commander. General Mattis stressed the keys to effectively employing this asset: it must be "employed rapidly and precisely against the enemy while avoiding civilian casualties." He also listed the requirements for effective employment of CAS in this environment as: Persistent observation; integrated intelligence, surveillance, and reconnaissance (ISR); and shortened approval procedures.[49] This program's plan to field a low-tech turbo-prop aircraft has the potential to provide a proactive approach to CAS, increasing its effectiveness while also providing a potential for building partner capacity.

History has shown that light low-tech aircraft have been successful in a COIN environment. After World War II, the T-6 Texan proved to be a successful aircraft in COIN. It was a cheap and readily available airframe with a long loiter time, making it an excellent spotter of observing artillery fire or spotting small insurgent bands. There are many examples of past counterinsurgents demonstrating success in using low-tech asset in COIN. The French used the T-6 in Algeria from 1954-1962, the United States the A-1 Skyraider in Vietnam in the 1960s, and the Salvadorans of the A-37 in El Salvador in the 1980s. In all three of these conflicts, the light attack aircraft have proven to be highly effective in COIN operations. The Salvadoran air

force had more than one hundred aircraft, with some A-37 trainers that served as strike aircraft. The improvements in the Salvadoran air force had a major impact on the military side of the war.[50] On the other side of the spectrum even with command of the skies and high-tech aviation assets, counterinsurgent groups have not been able to quell insurgencies. There are many examples of COIN operations in which countries that were battling an insurgency applied high-tech airpower and lost. A prime example was the United States in Vietnam, but other nations have also had this experience: the British in Palestine, the French in Indochina, the Soviets in Afghanistan, and the Israelis in Lebanon. In all these examples, the counterinsurgent had air supremacy but paid the price for over relying on their technological advantage. "Almost every time some new technology device appeared and was incorporated...it was quickly put to use in counterinsurgency too. Yet neither technical innovation nor command of the air brought victory..."[51]

The model for a counterinsurgent force is one that is centered around a light infantry force. For airpower to support that ground force, most counterinsurgency experts believe that an air force that is a not a high technology force will be the key force multiplier for the ground commander. Contrary to the argument made by Major Charles Havasy, USAF, *Close Air Support for Counterinsurgency: An Analysis of Aircraft Requirements*,[52] low-tech assets provide a better air capability for COIN operations that can aid in defeating an insurgency. David Galula, writer of *Counterinsurgency Warfare*, describes what the air force of the counterinsurgent should be: "For his air force, he wants ground support and observation planes of slow speed, high endurance, and great firepower, protected against small-arms ground fire; plus short take off transport planes and helicopters..."[53]

Lieutenant General John Pustay, USAF(Ret), describes what type of air component is ideal for COIN in his 1965 book *Counterinsurgency Warfare.* In it he focuses on what Brigadier General Jamie Gough, USAF, described as the "ideal" air force supporting the ground commanders in COIN. His criteria include short take-off and landing capabilities because of the potential for austere airfields; low slow flying aircraft, for identification of targets; multi-seat aircraft for airborne observers to fly on each mission; and aircraft that are easily maintained.[54] Since insurgent groups generally will not have any significant airpower with an air threat, there is no need for an aircraft to have air-to-air capabilities.

Potential Aircraft

The quest for a low-cost, low-tech, irregular warfare aircraft to provide ground pounders with long loitering, on-call recon and strike got a big boost recently when Joint Forces Command's Gen. James Mattis threw his support behind the Navy and Air Force "Imminent Fury" effort.

Greg Grant, *Defense Tech, March 19, 2010*[55]

USJFCOM Commander General Mattis testified in front of Congress on March 9, 2010, calling for a need of a Light Attack Armed Reconnaissance aircraft, to operate in a COIN environment. The U.S. Navy and U.S. Air Force have been working on a project, called *Imminent Fury*, to develop an aircraft to meet that requirement. This project was started after a need for a light attack armed reconnaissance aircraft was determined by General Stanley McChrystal for Special Operations Forces operating in Afghanistan. In July 2009, the Air Force officially began to research the feasibility of a Light Attack Armed Reconnaissance (LAAR) aircraft, and requested information from bidders on potential airframes to meet the need of a LAAR. General Stanley A. McChrystal, then Commander of U.S. forces in Afghanistan, subsequently in August 2009 sent an urgent request to the Pentagon's Joint Staff to expedite deployment of four new light attack aircraft needed by special operations commandos for

airstrikes against al Qaeda and the Taliban in Afghanistan.[56] The services agreed on the need for a light attack aircraft with the Air Force and the Navy actively pursuing research and development for an aircraft. The United States Marine Corps then stated in its *Marine Corps Operating Concepts*, June 2010, that there may be a need for a light attack platform.[57]

Due to aircraft performance, fuel burn rates, and fuel carrying capability, most turboprop aircraft have longer flight time then a jet aircraft. Increasing loiter time of the aircraft allows pilots to gain and maintain situational awareness (SA) over the objective, and it provides potential for maintaining aircraft presence. With a longer presence over the objective area, aircrews have the potential to attack the fleeting opportunities of engagement. This loiter time reduces the response time for troops in contact situations due to the fact aircraft are overhead on station longer. As the services ponder returning to the use of light, manned and prop-driven attack aircraft, similar to the OV-10 Broncos of Vietnam that carried out CAS missions, many now believe that turboprop-driven aircraft can augment the air component and enhance its mission capability. The LAAR operating in conjunction with UAVs and traditional fighters would thus provide a composite air component for the future of air forces in COIN. However the services must consider which aircraft to acquire, but in meeting this requirement has endured a difficult acquisition process.

On July 27, 2009, the USAF Aeronautical Systems Center Capabilities Integration Directorate began conducting market research assessment of fixed-wing platforms available for conducting strike, armed reconnaissance, and advanced aircraft training in support of Irregular Warfare (IW) operations. The capabilities that the U.S. Armed Forces are seeking in a LAAR platform are: (1) a two-seat turboprop, (2) good pilot visibility, (3) service ceiling of 30,000 feet, (4) ejection seats, (5) full motion video camera, (6) data link, (7) infrared suppressor, (8) radar

warning receiver, and (9) armored cockpit. The aircraft needs to have the capability of carrying various armaments, to include: four weapons stations, two of which can be used for external fuel; an aerial gun; capability to carry two 500-lb class munitions, employ 2.75 inch rockets, and employ rail-launched munitions, e.g. Hellfire missiles; and sensors to include laser designator and capability to generate coordinates for guided munitions. [58]

Currently, five potential contenders have been assessed as possibilities and are competing to become the aircraft to fill the role of a Light Attack Aircraft. They are the Hawker Beechcraft AT-6B Texan II, the Embraer's EMB-314 Super Tucano, the Air Tractor, of Texas AT-802U prototype, the Pilatus PC-9, and the potential Boeing OV-10X Bronco.[59] (See appendices D thru H) All five of these aircraft are viable options and meet most, but not all, of the criteria set forth by the U.S. Air Force's Air Combat Command's Capability Request for Information. Four of the five airframes are aircraft that are on the market either as commercial aircraft, trainers, or foreign military aircraft. They all provide an affordable off the shelf airframe option that can operate in the austere COIN environment.

LAAR Providing Effective CAS

The Strategic objective of protecting the people is of paramount importance in counterinsurgency operations; therefore, the air weapon-system selected should have pinpoint accuracy in the delivery of highly selective munitions. A strike can be considered effective only if the delivered munitions impact upon the enemy alone.

General Jamie Gough, USAF[60]

During Operation Anaconda (Shah-e-Kot Valley, Afghanistan; February-March 2002), issues arose with the employment of fixed wing CAS. Some of these were procedural and maneuvering challenges, hard viewing of the targets at high altitudes, and timing from target acquisition to target engagement. These issues led to the inability of supporting aircraft to attack

targets, especially when they were fleeting ones. What the ground forces found that worked in Afghanistan were tactics of Navy and Marine Corps aircraft that flew low enough to achieve desired effects, sometimes below minimum safe altitude.[61] In COIN, even though there is a requirement for armed aircraft that are providing CAS, considerations must be made for restraint as excessive firepower can damage the counterinsurgents cause. Ideally this means precision targeting with the right effects, target destroyed, minimal collateral damage, and no civilian casualties. In this type of conflict a ground force commander does not care about the number of bombs being dropped; instead, the key is whether or not the munitions are time-on-target with the right effects.[62]

History, after action reports (AAR) with amended lessons learned, has shown the difficulties and minimal overall effects superior high technology airpower has had in a COIN environment. CAS platforms operating in a COIN environment must be able to provide timely and accurate fires against a fleeting adversary. Most of the time accurate fire requires great situational awareness (SA) and close unobstructed line of sight for visual reference of the objective area. Identification of the target can be difficult for fast moving jet pilots, even the best trained ones with enhanced technological equipment. Also, long loiter time near or over the objective area is a must. The proposed light attack aircraft planes will give an appropriate COIN aircraft to the U.S. air services. With multi-piloted high visibility cockpits, these airframes can provide the pilot with better SA and visual reference of the objective area than may be achieved by faster jet aircraft. Major General Franklin L. Hagenbeck, commander of ground forces in Operation Anaconda, stated his frustrations with CAS aircraft by saying, "Our fixed-wing pilots…had a very small view of the target areas from their cockpits, about the size of a postage stamp."[63]

LAAR in the Airborne Controllers Role

The light attack armed reconnaissance aircraft that are being considered are all multi-piloted airframes. With two aviators in the cockpit, the overall situational awareness of the cockpit is increased. With good cockpit resource management (CRM), a light attack aircraft can become an airborne controller. As an extension of the TACP or DASC, the aircrew can assume the role of a TAC(A), FAC(A) or ASC(A), i.e., whatever the mission dictates. The slower airspeeds and maneuverability of the LAAR lend itself to controlling other aircraft whether they are other attack platforms, unmanned aerial systems (UAS), or assault support aircraft. Having an increase in SA of the objective area, the aircrew can help increase the SA of the FACs and JTACs on the ground while reducing their workload during taxing times. This type of aircraft has already proven suitable in the Forward Air Control role. Currently the Australian Air Force uses the Pilatus PC-9 in a FAC(A) role.[64] Bringing the capabilities of airborne controllers into the objective area increases the efficiency of the employment of CAS in COIN. Potentially more efficient flow of aircraft into and out of the objective area, increased SA for everyone in the objective area, and reduction of time for employment of aircraft, is how airborne controllers can increase the efficiency.

Operating near the FLOT

With the requirement for the LAAR to be a short take off and landing (STOL) platform, the aircraft will have the capability to operate in an austere environment. Currently most forward operating bases (FOB) have minimal rugged airfield capabilities, to include unimproved runways. Aircraft operating from these FOBs need to be able to operate from short runways, and be able to withstand the wear and tear of operating from the unimproved airfields. All potential LAAR aircraft have STOL capabilities and are rugged enough to operate from unimproved

runways and dirt strips. Non-flight related battle damage and indirect fires are considerations that need to be made while operating out of a FOB. Even though these FOBs have secure airfields, the aircraft will be exposed to potential indirect fires. Deploying high-tech aircraft to area where they may be exposed to indirect fires where they can be destroyed can be costly. The destruction on the ground of one of these assets can be both a budgetary and information operation loss. However, most of the aircraft that are being considered for the LAAR are "off the shelf" aircraft from a commercial manufacturer. These airframes are thus less expensive and the severity of any loss can be reduced, and they can be easily replaced. Because they are "off the shelf", parts will also be easily accessible for repairs.

In an *Air Land and Sea Bulletin: Irregular Warfare* article, a price comparison was made between a conceptual LAAR aircraft and high-tech jet aircraft. In an article titled, "Making the Case for the OA-X Light Attack Aircraft" (2010), Lieutenant Colonel Pietrucha, UASFR and Lieutenant Colonel Torres-Laboy, USAF, make an argument for a low-tech turboprop aircraft for the irregular warfare and COIN environments. The OA-X, a conceptual LAAR aircraft, would be similar to the requirements for the LAAR. In their argument they bring up the point about costs, both fuel and operations cost. In their comparison of a F-16 squadron and a OA-X squadron, they determined that the OA-X could save 5% in fuel costs alone. They then compared the operational cost per hour of an OA-X to F-16s, F-15s and found that the OA-X would cost $1,500/hour vice F-16s at $9,019 and F-15s at $18,050.[65]

Having the capability to forward deploy an aircraft and operate out of the same FOB as the ground units it supports increases the capabilities of the air and ground maneuver team. Being collocated, aviation squadrons can develop operational relationships with the infantry units they are supporting. During a deployment to Afghanistan from February to October in

2008, the Canadian Army's 2 Princess Patricia's Canadian Light Infantry (2 PPCLI BG) and the United States Air Force's 451st Air Expeditionary Group (451st AEG) developed an exemplary working relationship with each other. The 451st AEG, a Reaper Squadron, were collocated with the 2 PPCLI BG at Kandahar Air Base in Afghanistan. Strong Personal and Operational relationships developed between the operators of the UAVs and the Brigade. "The constant interaction… was critical to ensuring an acute awareness and common understanding of the battlespace".[66] Squadrons that are collocated on the same FOB with the supported ground units, increase their understanding of the battlespace, and have a greater understanding of the supported unit's operational plan.

Building Partnership Capacity

U.S. and multinational operations strive to enable the host nation to provide its own internal and external defense. With the HN's requirements in mind, planners should develop an airpower capability that meets the needs and abilities of the HN.[67] The U.S. armed forces need to plan for the future of the HN in the COIN operations. Most of the time, HN forces need to be quickly trained and equipped to take over the COIN fight from the United States. This is as true with the HN air force as with its ground components. The United States should look at affordable, easily maintainable, and easily trainable aircraft to fill the airpower roles. The key is developing and using a cost effective airframe for CAS in COIN that can not only be used by both the United States air component, but also serve as a platform for the HN's air force. Using the LAAR aircraft in a COIN environment, while simultaneously training the HN air component on the LAAR, would be a cost effective way to conduct COIN operations. When the COIN operations are ultimately turned over to the HN, potentially the U.S. government could sell or

turn over LAAR to the HN and because of the minimal infrastructure needed LAAR aircraft equivalent would be ideal for building the HN air component.

Conclusion

Defining effective CAS in a COIN environment is the ability to employ munitions with precision and discrimination, ideally with limited to no collateral damage or civilian casualties.[68] Due to the nature of COIN operations, the opportunities for employing CAS will be limited because of the insurgents' guerrilla tactics and their relying on concealment and mobility within the population. They operate with relative impunity, only massing immediately prior to an attack thus giving only fleeting opportunities for engagement.[69]

Airpower is a critical force multiplier in today's COIN environment, but with controversial elements to it. Conducting close air support in COIN requires great precision and accuracy. Mistakes with CAS in COIN can set back the counterinsurgent forces what took years to gain. Collateral damage and civilian casualties need to be limited or eliminated all together. With the scrutiny that is placed on airpower's strike capability, specifically CAS, pilots and FACs need to take great care with the conduct of their missions. Currently, as the U.S. Air Force and Navy continue to work on fielding a turboprop aircraft, all services that conduct CAS need to look heavily into using such low-tech asset. The LAAR program's planned airframe will bring an enhanced capability to the battlefield, making airpower an even enhanced force multiplier. Using a turboprop aircraft will allow all services that conduct CAS to be more effective at prosecuting targets. They will also be more economically efficient. With today's push to be more effective and efficient, the light attack aircraft is the perfect platform for the CAS role.

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Appendix A

Acronyms

AAR – After Action Report

ACE – Aviation Combat Element

AEG – Air Expeditionary Group

AFDD – Air Force Doctrine Document

AirO – Air Officer

ASC(A) – Assault Support Coordinator (Airborne)

CAS – Close Air Support

COIN – Counterinsurgency

CRM – Crew Resource Management

DASC – Direct Air Support Center

DoD – Department of Defense

FAC – Forward Air Controller

FAC(A) – Forward Air Controller (Airborne)

FARP – Forward Arming Refueling Point

FID – Foreign Internal Defense

FLOT – Forward Line of Troops

FM – Field Manual

FOB – Forward Operating Base

FSCM – Fire Support Coordination Measure

FSCC – Fire Support Coordination Center

FW – Fixed Wing

GCE – Ground Combat Element

HN – Host Nation

IED – Improvised Explosive Device

ISR – Intelligence Surveillance Reconnaissance

IW – Irregular Warfare

JFO – Joint Fires Observer

JSF – Joint Strike Fighter

JTAC – Joint Terminal Attack Controller

LAAR – Light Attack Armed Reconnaissance

MAGTF – Marine Air-Ground Task Force

MCWP – Marine Corps Warfighting Publication

MEF – Marine Expeditionary Unit

MSTP – MAGTF Staff Training Program

OEF – Operation Enduring Freedom

OIF – Operation Iraqi Freedom

PPCLI BG - Princess Patricia's Canadian Light Infantry Brigade

QDR – Quadrennial Defense Review

ROE – Rules of Engagement

RW – Rotary Wing

SA – Situational Awareness

SASO – Security and Stabilization Operations

STOL – Short Take-Off Landing

STOVL – Short Take-Off Vertical Landing

TAC(A) – Tactical Air Coordinator (Airborne)

TACP – Tactical Air Control Party

TIC – Troops in Contact

UAS – Unmanned Air System

UAV – Unmanned Air Vehicle

USAF – United States Air Force

USJFCOM – United States Joint Forces Command

USMC – United States Marine Corps

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(Joint Tactics, Techniques, and Procedures for Close Air Support (CAS): Joint Publication 3-09.3)

(Marine Corps Supplement to the Department of Defense Dictionary of Military and Associated Terms: MCRP 5-12C)

Appendix B

Glossary of Terms

Air Officer—An officer (aviator/naval flight officer) who functions as chief advisor to the commander on all aviation matters. An air officer is normally found at battalion level and higher within the ground combat element and within the Marine air-ground task force command elementand combat service support element headquarters staffs. The air officer is the senior member of the tactical air control party. The battalion air officer supervises the training and operation of the two battalion forwardair control parties. Also called **AO** or **AirO**.

Air Strike — An attack on specific objectives by fighter, bomber, or attack aircraft on an offensive mission. May consist of several air organizations under a single command in the air.

Assault Support Coordinator (Airborne) - An aviator who coordinates, from an aircraft, the movement of aviation assets during assault support operations. Also called ASC(A). Formerly referred to as helicopter coordinator (airborne) or HC(A).

Aviation Combat Element — The core element of a Marine air-ground task force (MAGTF) that is task-organized to conduct aviation operations. The aviation combat element (ACE) provides all or a portion of the six functions of Marine aviation necessary to accomplish the MAGTF's mission. These functions are antiair warfare, offensive air support, assault support, electronic warfare, air reconnaissance, and control of aircraft and missiles. The ACE is usually composed of an aviation unit headquarters and various other aviation units or their detachments. It can vary in size from a small aviation detachment of specifically required aircraft to one or more Marine aircraft wings. The ACE itself is not a formal command. Also called **ACE.**

Close Air Support — 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. Also called **CAS.**

Direct Air Support Center — The principal air control agency of the US Marine air command and control system responsible for the direction and control of air operations directly supporting the ground combat element. It processes and coordinates requests for immediate air support and coordinates air missions requiring integration with ground forces and other supporting arms. It normally collocates with the senior fire support coordination center within the ground combat element and is subordinate to the tactical air command center. Also called **DASC.**

Forward Air Controller — An officer (aviator/pilot) member of the tactical air control party who, from a forward ground or airborne position, controls aircraft in close air support of ground troops. Also called **FAC.**

Forward Air Controller (Airborne) - A specially trained and qualified aviation officer who exercises control from the air of aircraft engaged in close air support of ground troops... normally an extension of the tactical air control party (TACP). Also called **FAC(A).**

Forward Arming and Refueling Point — A temporary facility — organized, equipped, and deployed by an aviation commander, and normally located in the main battle area closer to the area where operations are being conducted than the aviation unit's combat service area — to provide fuel and ammunition necessary for the employment of aviation maneuver units in combat. The forward arming and refueling point permits combat aircraft to rapidly refuel and rearm simultaneously. Also called **FARP.**

Foreign Internal Defense — Participation by civilian and military agencies of a government in any of the action programs taken by another government or other designated organization to free and protect its society from subversion, lawlessness, insurgency, terrorism, and other threats to its security. Also called **FID.**

Forward Line of Own Troops — A line that indicates the most forward positions of friendly forces in any kind of military operation at a specific time. The forward line of own troops normally identifies the forward location of covering and screening forces. The forward line of own troops may be at, beyond, or short of the forward edge of the battle area. An enemy forward line of own troops indicates the forward-most position of hostile forces. Also called **FLOT.**

Forward Operating Base — An airfield used to support tactical operations without establishing full support facilities. The base may be used for an extended time period. Support by a main operating base will be required to provide backup support for a forward operating base. Also called **FOB.**

Fire Support Coordination Measure — A measure employed by land or amphibious commanders to facilitate the rapid engagement of targets and simultaneously provide safeguards for friendly forces. Also called **FSCM.**

Fire Support Coordination Center — A single location in which are centralized communications facilities and personnel incident to the coordination of all forms of fire support. Also called **FSCC.**

Ground Combat Element — The core element of a Marine air-ground task force (MAGTF) that is task-organized to conduct ground operations. It is usually constructed around an infantry organization but can vary in size from a small ground unit of any type, to one or more Marine divisions that can be independently maneuvered under the direction of the MAGTF commander. The ground combat element itself is not a formal command. Also called **GCE.**

Joint Fires Observer — A trained Service member who can request, adjust, and control surface-to-surface fires, provide targeting information in support of Type 2 and 3 close air support terminal attack control, and perform autonomous terminal guidance operations. Also called **JFO.**

Joint Terminal Attack Controller — A qualified (certified) Service member who, from a forward position, directs the action of combat aircraft engaged in close air support and other offensive air operations. A qualified and current joint terminal attack controller will be recognized across the Department of Defense as capable and authorized to perform terminal attack control. Also called **JTAC.**

Marine Air-ground Task Force — The Marine Corps principal organization for all missions across the range of military operations, composed of forces task-organized under a single commander capable of responding rapidly to a contingency anywhere in the world. The types of forces in the Marine air-ground task force (MAGTF) are functionally grouped into four core elements: a command element, an aviation combat element, a ground combat element, and a combat service support element. The four core elements are categories of forces, not formal commands. The basic structure of the MAGTF never varies, though the number, size, and type of Marine Corps units comprising each of its four elements will always be mission dependent. The flexibility of the organizational structure allows for one or more subordinate MAGTFs to be assigned. Also called **MAGTF.**

Strike — An attack to damage or destroy an objective or a capability.

Tactical Aircraft Coordinator (Airborne) - An officer that who coordinates from an aircraft, the actions of other aircraft engaged in air support of ground forces. Also called TAC(A).

Tactical Air Control Party—A subordinate operational component of a tactical air control system designed to provide air liaison to land forces and for the control of aircraft. (Joint Pub 1-02) In the Marine Corps, tactical air control parties are organic to infantry divisions, regiments, and battalions. Tactical air control parties establish and maintain facilities for liaison and communications between parent units and airspace control agencies, inform and advise the ground unit commander on the employment of supporting aircraft, and request and control air support. Also called **TACP**.

Sources:

(Department of Defense Dictionary of Military and Associated Terms: Joint Publication 1-02)

(Joint Tactics, Techniques, and Procedures for Close Air Support (CAS): Joint Publication 3-09.3)

(Marine Corps Supplement to the Department of Defense Dictionary of Military and Associated Terms: MCRP 5-12C)

Appendix C

Appendix E, Airpower in Counterinsurgency (Summary)

FM 3-24/MCWP 3-33.5

OVERVIEW

E-1. Airpower can contribute significant support to land forces conducting counterinsurgency operations.

E-2. Airpower provides considerable asymmetric advantages to counterinsurgents.

E-3. Effective leaders also use airpower in roles other than delivering ordnance.

E-4. Air transport can also quickly deliver humanitarian assistance.

AIRPOWER IN THE STRIKE ROLE

E-5. Precision air attacks can be of enormous value in COIN operations; however, commanders exercise exceptional care when using airpower in the strike role. An airstrike can cause collateral damage and civilian casualties that turns people against host-nation (HN) government and provides insurgents with a major propaganda victory.

E-6. Even when destroying an obvious insurgent headquarters or command center, counterinsurgents must take care to minimize civilian casualties.

AIRPOWR IN INTELLIGENCE COLLECTION

E-7. Given the challenges faced by human intelligence (HUMINT) assets in finding and penetrating insurgent networks, counterinsurgents must effectively employ all available intelligence collection capabilities.

E-8. When insurgents operate in rural or remote areas, aerial reconnaissance and surveillance proves useful.

E-9. Air assets have proven important in tactical operations and in convoy and route protection.

E-10. However, intelligence obtained through air and space platforms works best when it is quickly and efficiently routed to a joint intelligence center.

E-11. HUMINT is also a key enabler of airpower in the strike role.

AIR AND SPACE INFORMATION OPERATIONS

E-12, E-13, E-14, and E-15 (Do not apply to this paper.)

HIGH-TECHNOLOGY ASSETS

E-16. Today's high-technology air and space systems, such as the Predator, have proven their worth in COIN operations.

LOW-TECHNOLOGY ASSETS

E-17. Today's low-technology aspects of airpower have also proven effective in COIN operations. Light, slow, inexpensive civilian aircraft have successfully patrolled border areas.

E-18. The United States and many small nations have effectively used aerial gunships as close air support weapons in COIN operations.

AIRLIFT

E-19, E-20, E-21, E-22, and E-23 (Do not apply to this paper.)

THE AIRPOWER COMMAND STRUCTURE

E-24, E-25, E-26, and E-27 (Do not apply to this paper.)

BUILDING HOST-NATION AIRPOWER CAPABILITY

E-27. U.S. and multinational operations strive to enable the host nation to provide its own internal and external defense. For conducting effective COIN operations, a HN air force requires the following basic capabilities: Aerial reconnaissance and surveillance, air transport, close air support for land forces, helicopter troop lift, MEDEVAC, counterair, and interdiction.

E-28. The first step in developing a HN airpower is developing the right organizational model for a HN air force.

E-29. The next step is to help the host nation develop its aviation infrastructure under a long-term plan.

E-30. An important training asset is the U.S. Air Force Special Operations Command.

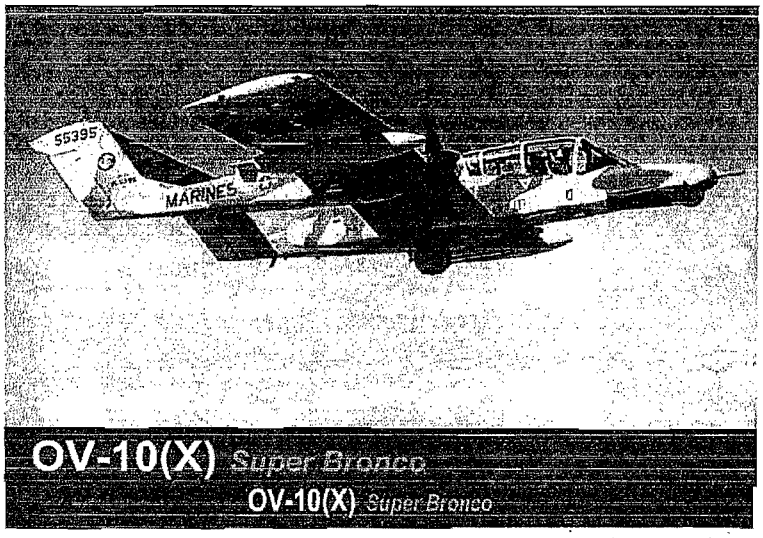
E-31. Planners should consider HN economic and technological resources when selecting equipment.

E-32. Training and developing a capable HN air force takes considerable time due to the requirements to qualify aircrews, maintenance personnel, and other specialists.

E-33. Developing capable air forces usually takes longer than developing land forces.

Appendix D

Boeing OV-10X: *Super Bronco*



OV-10(X) Super Bronco

DESIGN

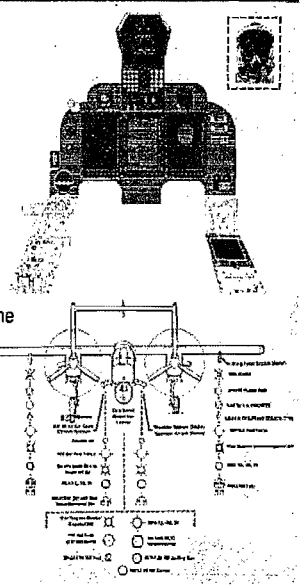
- Designed and built for the ***full*** **COIN mission**
  – ISR, CAS, FAC, light utility
- 110 ft³ cargo capacity with 3200 lb payload
- Ample expansion capacity for evolving needs, including network-centric operations
- Nose-mounted targeting sensor and radar
- Cockpit armor, zero-zero ejection seats, IR suppression, fuel protection
- AAR-54/ALE-47 missile warning/countermeasures

PERFORMANCE

- Twin-turboprop performance and survivability
- 30,000-ft normal service ceiling; 12,500 ft single engine
- Up to 6.2-hr loiter time with external fuel
- STOL operation from unimproved runways

ARMAMENT

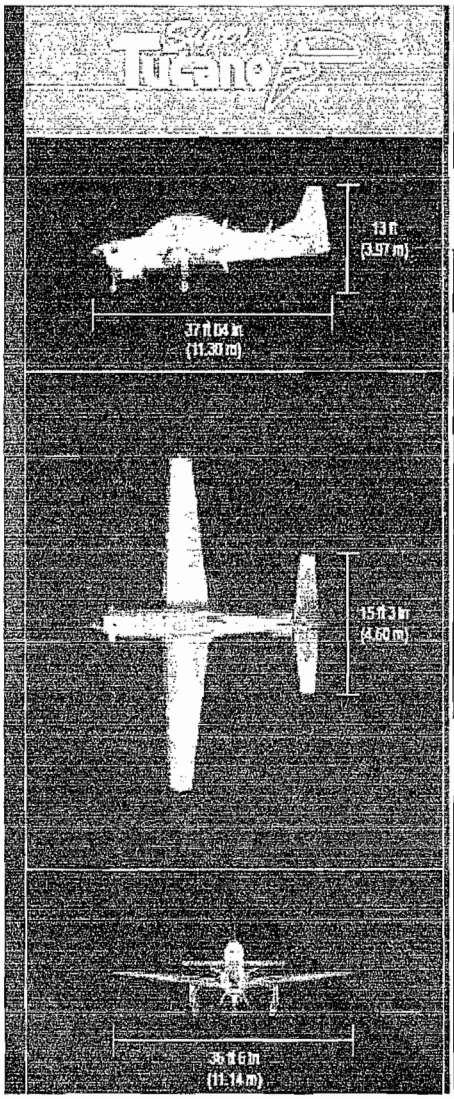
- Four sponson stations for rockets, miniguns or stores
- Two .50 cal machine guns inside each sponson
- Centerline station for 30mm gun, stores or fuel
- Two wing stations for rockets and missiles
- Up to 16 HELLFIRE missiles carried on wing and sponson stations



(http://www.ov-10bronco.net/Technical/boeing_ov-10(x)_super_bronco_info_card_2009_01.pdf)

Appendix E

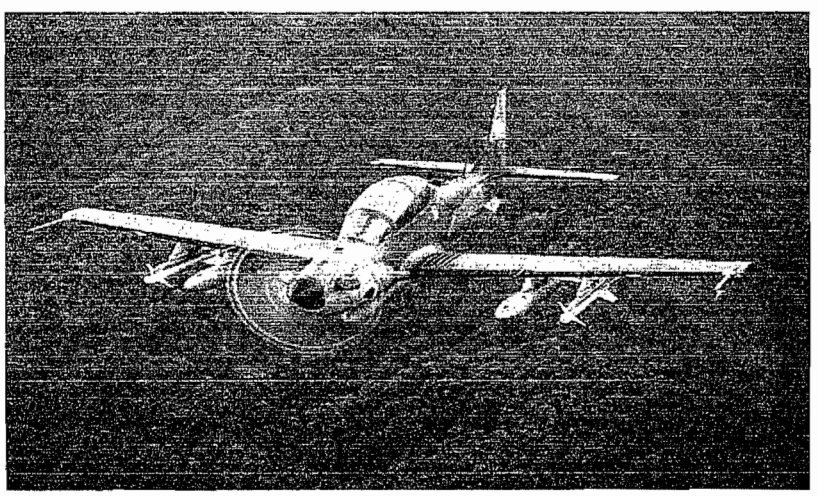
Embraer: *Super Tucano*



Weights	
Empty weight	3,250 kg / 7,055 lb
Max. takeoff weight	5,400 kg / 11,905 lb
Payload (external loads / stores)	1,550 kg / 3,420 lb

Performance	
Max. level speed (clean)	593 km/h / 320 kias
Cruise speed	520 km/h / 280 kias
Stall speed	148 km/h / 80 kias
Service ceiling	10,695 m / 35,005 ft
Ferry range – internal fuel	1,445 km / 780 nm
Ferry range – with external tanks	2,855 km / 1,540 nm
Endurance – internal fuel	3.4 hours
Endurance – with external tanks	8.4 hours
Takeoff field length	900 m / 2,550 ft
Landing field length	860 m / 2,620 ft

Airframe	
G-limits	7g / -3.5 g
Pressurization	5.0 psi
Ejection seats	Martin-Baker Mk 10
Fatigue life	12,000 hours (typical combat) 18,000 hours (typical training)
Windshield	Resistant to impacts from 4 lb birds at 360 ktas



(http://www.embraerdefensesystems.com/english/content/combat/tucano_origin.asp)

Appendix F

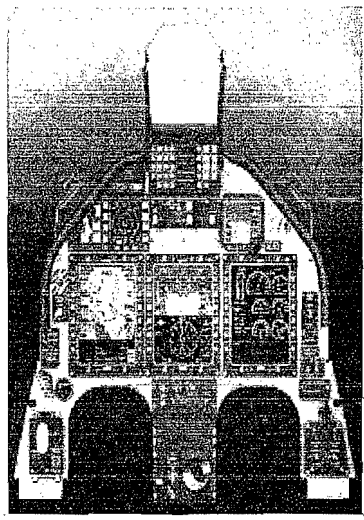
Beechcraft: *AT-6*

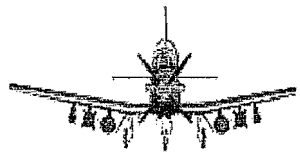
The BEECHCRAFT® AT-6

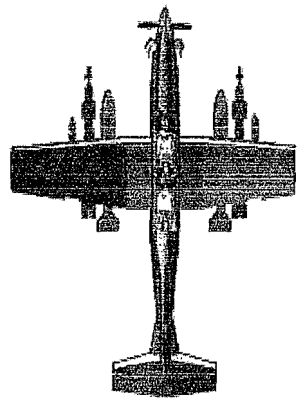
The next evolution of special missions aircraft.

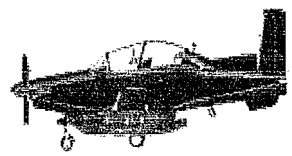
One platform with multiple missions: initial pilot training, weapons training, operational NetCentric ISR and light attack capabilities for irregular warfare. The **BEECHCRAFT AT-6** is a multi-role, multi-mission aircraft system designed to meet a wide spectrum of warfighter needs.

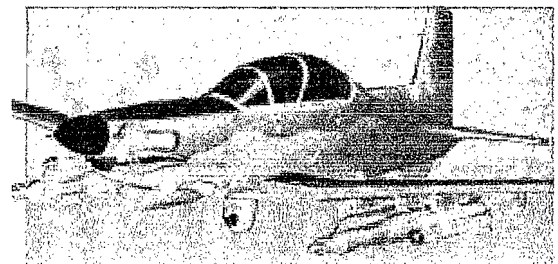
- A structurally strengthened spiral development of the proven USAF Beechcraft T-6A and USN T-6B
- Designed to accommodate 95% of the aircrew population; the widest range in its class
- Lockheed Martin plug-and-play mission system architecture adapted from A-10C
- Flexible, reconfigurable hardpoints with seven external store stations
- Long persistence with two aircrew and weapons; up to 1,350 nm self-deployment range
- Extensive variety of integrated weapons including general purpose, laser guided and inertially-aided munitions
- Well established logistics infrastructure for more than 550 aircraft (growing to a 900+) fleet worldwide











Unparalleled attributes and a wide range of options.

AIRFRAME AND POWERPLANT
- 1,600 shaft horsepower engine options
- One ISR suite hardpoint and six external stores hardpoints

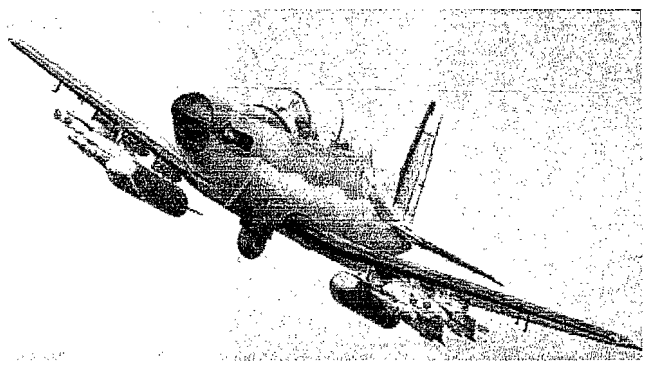
AIRCRAFT SELF PROTECTION
- Light armor
- Infrared missile warning and countermeasures
- Fuel cell protection

COMBAT MISSION SYSTEMS
- Plug-and-Play mission system
- NVIS cockpit
- Helmet-mounted cueing system

COMMUNICATIONS SUITE
- Secure voice and data
- ROVER-compatible full motion video
- SADL/ Link-16 compatible
- SATCOM

ISR SUITE
- MX-15D/ MTS-A compatible

WEAPONS INTEGRATION
- 1760 capable stores management system
  - .50 Cal Gun
  - 20mm Gun
  - 250/500 lb general purpose bombs
  - 250/500 lb laser guided bombs
  - 250/500 lb inertially aided bombs (GPS)
  - Laser guided missiles
  - Laser guided rockets
  - Small 1760 weapons



(http://www.hawkerbeechcraft.com/military_and_special_mission/light_attack.aspx)

Appendix G

Air Tractor: *AT-802U*

Specifications

ENGINE TYPE	Pratt & Whitney PT6A-67F
ENGINE TAKEOFF SHP – UNINSTALLED	1,600 @ 40.0° C, 1,700 rpm
ENGINE MAXIMUM CONTINUOUS SHAFT HORSEPOWER – UNINSTALLED	1,500 @ 27.5° C, 1,700 rpm
PROPELLER	118 in (300 cm) diameter, aluminum Hartzell
PROPELLER GROUND CLEARANCE	39 in (0.99 m)
GROSS WEIGHT – LANDING & TAKEOFF	16,000 lbs (7,257 kg)
EMPTY WEIGHT, WITH ARMOR, NO WEAPONS	7,836 lbs (3,703 kg)
USEFUL LOAD WITH BALLISTIC ARMOR	8,164 lbs (4,000 kg)
FUEL CAPACITY – WINGS	380 US gal (1,438 L)
AUXILIARY FUEL CAPACITY – FUSELAGE	360 US gal (1,363 L)
WINGSPAN	59.2 ft (18.04 m)
WING AREA	401 ft² (37.25 m²)
MAIN WHEEL SIZE	32.0 in (81.28 cm)

Performance

MAXIMUM SPEED, NO WEAPONS, AT 10,000 FT (3,048 M)	213 knots (394 kph)
PATROLLING SPEED AT 10,000 FT; 71 US GAL PER HOUR (3,048 M; 269 L PER HOUR)	180 knots (333 kph)
STALL SPEED, FLAPS DOWN, AT MAX GROSS WEIGHT	91 knots (169 kph)
STALL SPEED, AT 12,500 LBS (5,670 KG)	70 knots (130 kph)
RANGE WITH AUXILIARY FUSELAGE FUEL, ECONOMY CRUISE AT 9,000 FT (2,438 M)	1,310 nm (2,414 km)
LANDING RUN	1,200 ft (366 m)

GROSS WEIGHT	TAKEOFF ROLL	RATE OF CLIMB
FULL FUEL LOAD, 10,000 LBS (4,536 KG)	660 ft (207 m)	3,000 fpm (914 mpm)
SURVEILLANCE LOAD, 12,500 LBS (5,760 KG)	1,100 ft (325 m)	2,300 fpm (676 mpm)
SURVEILLANCE & WEAPONS LOAD, 14,500 LBS (6,500 KG)	1,400 ft (425 m)	1,700 fpm (518 mpm)

Standard Features

Ballistic glass and cockpit/engine armor • Self-sealing fuel tanks and emergency fuel transmitter shut off • AMEAFE inertial restraint system integrated with 5 point harness • Air conditioner • Large and reconfigurable fuel system • Rough strip, all airfield landing gear • High dust environmental induction system

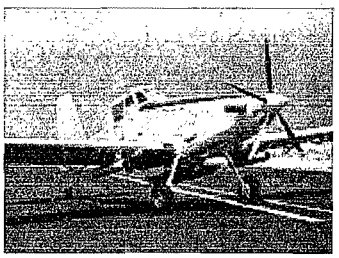
A TRUE IRREGULAR WARFARE AIRCRAFT

The AT-802U is the first expeditionary CAS aircraft designed to operate from dirt roads and rough airfields teamed with ground forces in forward combat areas. This rugged aircraft combines an 8,000-pound payload and 10-hour mission endurance with the flexibility and responsiveness of a manned weapon system – all for a fraction of the cost of modern UAV systems.

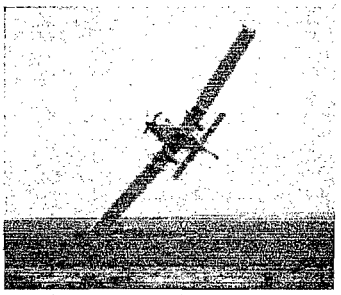
- Precision force application
- Real-time eye in the sky for ground troop support
- Integrated fire control system
- Training-focused force support
- Small logistics footprint

Particularly well suited for force application and situational awareness roles in asymmetrical warfare theatres of operation, the AT-802U is both economical and effective. Like a truck, the aircraft is utilitarian in nature: tough, powerful and configurable to simply get the job done. It can maintain very long endurance over target and can employ a wide range of weapons simultaneously, with a high degree of accuracy to minimize collateral damage.

With its balloon tires and rugged landing gear, the AT-802U is built to land and operate off unimproved airstrips – even dirt roads – providing unprecedented direct support and coordination with ground troops. The AT-802U can fly in extreme heat and dust conditions and with its massive fuel reserves, loiter over target to find, fix and finish when other fighters have to return to the tanker.



AT-802U: Versatile, rugged, and dependable.

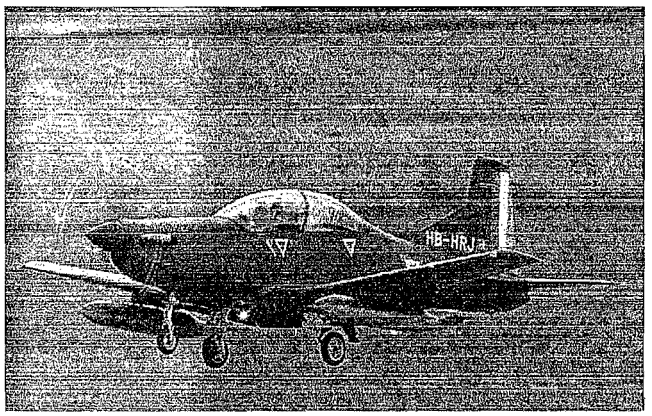


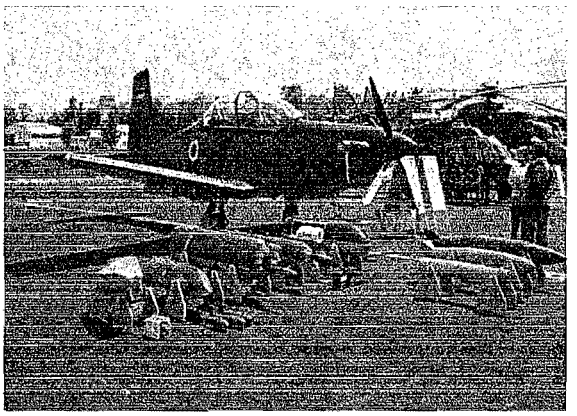
The AT-802U is designed to be maneuverable with a full payload.

(http://www.airtractor.com/aircraft)

Appendix H

Pilatus: *PC-9M*





Pilatus PC-9M Statistics

Aircraft Type	Pilatus PC-9M
Role(s)	Ab Initio, advanced & instructor pilot training and close air support
Crew	1 Pilot & 1 Student
Powerplant	1 x Pratt & Whitney PT6A-62 turbo prop
Wing Span	10.19 metres (33 feet, 5 inches)
Height	3.25 metres (10 feet, 8 inches)
Length	10.16 mts. (33 feet, 4 inches)
Armament	• 2 x Rocket Pods - Holding x 2.75" (70mm) 'FN LAU 7' Folding Fin Aerial Rockets • 2 x .5" FN HMG - Each gun with a 250 round belt
Entered Service	2004

Pilatus PC-9M Performance

Max T/O Weight	3,200 Kilogrammes (7,050 pounds)
Service Ceiling	25,000 feet
Cruise Speed	275 knots
Maximum Speed	320 knots
Endurance	4 hours, 30 minutes
Range	850 Nautical Miles

(http://www.pilatus-aircraft.com/)

Bibliography

The subject of the paper, a light turbo-prop aircraft for CAS in COIN, is a highly debated topic with many viewpoints on the subject. Finding that there were numerous other monographs written about this topic, for and against a light attack armed reconnaissance aircraft, no one seemed to have taken a viewpoint based on what the theorist and doctrine say. This thesis takes those two key elements and history, looking at what challenges faced today and argues for the need for a light attack armed reconnaissance aircraft.

That being said, I found that I needed to build the basis for this paper off of the past, pull it into the present, and look at the future. Because of this the two books that I felt were a great foundations were, *A History of Air Warfare* and *Airpower in Small Wars: Fighting Insurgents and Terrorists.* As far as theorists, I tried to broaden the horizons. I did not want to just concentrate on the big ones, David Galula, John Nagl, David Kilcullen, Callwell, et al. I searched for those that had some theories on airpower in COIN, Major John S. Pustay, USAF and General Charles J. Dunlap, USAF. Based on that research, I found that: *Understanding Counterinsurgency: Doctrine, Operations and Challenges*; *Counterinsurgency Field Manual* (The University of Chicago Press); *Counterinsurgency Warfare*; and RAND Corps', *Air Power in the New Counterinsurgency Era, War By Other Means, Beyond Close Air Support. Forging a New Air-Ground Partnership* had valuable insight to questions and the values of airpower in COIN.

Also, I used two monographs that were written by fellow military professionals, helpful and full of opinions that steered my research. These papers helped in finding additional resources, and arguments that supported my thesis. *Close Air Support for Counterinsurgency:*

An Analysis of Aircraft Requirements and *Back to Basics: An Aviation Soulution to the Counterinsurgent Warfare,* were two papers written by Air Force Majors at the Air Command and Staff College, that help frame this thesis.

The next two groups of resources were the various articles that were found and the Department of Defense's annual publications. All had great arguments for and against many of the facets of Airpower in COIN. They all provided information that aided in the development of the arguments for the thesis. The DoD publications gave insight into the direction of where the DoD is heading, and this in turn helped structure the argument for this thesis. The journal articles also added weight to this article.

The last sets of references were speeches that have been given. These gave the insight into what senior officials were thinking, and what their direction is for the DoD, using this information, helped to add even more weight to the argument.

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