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THESIS

**TECHNOLOGICAL INNOVATION: ROLES AND
IMPLICATIONS IN ARMY AVIATION SPECIAL
OPERATIONS**

by

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December 2008

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**TECHNOLOGICAL INNOVATION: ROLES AND IMPLICATIONS IN ARMY
AVIATION SPECIAL OPERATIONS**

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The Global War on Terror and recent shift of focus from conventional warfare to unconventional warfare reflects a need to replace Cold War era helicopters. Case studies including the development of the AH-56 Cheyenne, OH-13 Sioux, and the MH-60 Direct Action Penetrator provide reference points to develop a general premise of the aviation community's ability to capitalize on technological innovations. Examining the process of innovation throughout the history of Army Aviation will provide a framework to apply the concepts of innovation to the present and future operations of Army Aviation Special Operations. The diffusion of innovation theory identifies that 2.5% of the whole represents the true innovators. The size of the 160th Special Operations Aviation Regiment (SOAR), representing approximately 5% of the entire Army aircraft inventory, is analogous with the concept of true innovators. The 160th SOAR is a great option for the integration of an advanced commercial aircraft, meeting the requirement for a specialized aircraft in Special Operations and the advancement of aircraft for the conventional Army.

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TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	HISTORY OF AVIATION	7
A.	HOT AIR BALLOONS	7
B.	POWERED FLIGHT	8
C.	THE HELICOPTER	9
D.	TURBINE ERA	10
E.	CREATION OF ARMY AVIATION SPECIAL OPERATIONS	12
III.	AVIATION TECHNOLOGICAL INNOVATION: SUCCESSES AND FAILURES	17
A.	INNOVATION AND THE MILITARY	17
B.	AH-56 CHEYENNE	21
C.	RAH-66	23
D.	OH-13 SIOUX	24
E.	COLONEL VANDERPOOL'S TEAM	26
F.	DIRECT ACTION PENETRATOR (DAP)	27
G.	INNOVATION APPLIED	28
IV.	ROLE OF INNOVATION IN AVIATION SPECIAL OPERATIONS	31
A.	FOCUS OF TECHNOLOGY	31
B.	CORE TASKS	32
C.	FINANCING TECHNOLOGY	33
D.	OBSTACLES TO INNOVATION	35
E.	TIME FOR CHANGE	36
V.	CONCLUSION	39
	LIST OF REFERENCES	43
	INITIAL DISTRIBUTION LIST	47

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I. INTRODUCTION

A military's ability to wage a war can be defined by two factors, the individuals who conduct the fight and the equipment that they fight with. The capability of the individual to fight effectively is affected by factors such as training, doctrine, discipline, and education, all of which are subjective to human nature. For example, instituting a training program will ensure that the soldiers are properly exposed to the methods needed to fight in combat, but ultimately, it still comes down to the individual's character traits that determine his effectiveness at waging war. These "soft" factors can be difficult to quantify. However, there are "hard" factors, such as weapons technology, that can be quantified in comparisons to the advantages that they may offer a military over their adversaries. Even though the ultimate factor in winning a war comes down to the individual soldier, not having the correct tools and equipment to efficiently complete the mission can seriously degrade the probabilities of victory.

Special Operations Forces (SOF) have an even greater responsibility placed upon them as they are considered to be the elite forces of the military. These forces are given the responsibility of conducting high-risk missions, with relatively few personnel, that should ultimately have an effect of strategic importance. To achieve this status of "special," SOF personnel often undergo a selective screening process in order to distinguish their potential and proclivity for conducting special operations followed by

extensive highly specialized training. Examples of these types of forces include the Navy Seals, Army Special Forces and the Army's Special Aviation Unit, the 160th Special Operations Aviation Regiment (SOAR). The characteristics that distinguish these forces from conventional forces have been described by Tucker and Lamb as possessing political sophistication, having the uncommon will to succeed, utilizing unorthodox approaches, employing unconventional equipment and training, and having special intelligence requirements.¹ This paper is focused primarily on the fourth characteristic of unconventional, or technologically superior, equipment.

The 160th SOAR is probably even more reliant upon unconventional or technically superior equipment than the other special operations units of the U.S. Army. The main purpose for the 160th in the field of special operations is to provide mobility to the ground SOF of the U.S. military. In order to most effectively conduct this mission in the face of any deadly adversary, their weapon platform of choice, the helicopter, should be technically superior in agility, speed, electronic countermeasures, navigational ability, and durability. Often, the missions that the 160th is engaged in, are considered either sensitive or strategically important, which increase their responsibility of not failing in achieving the desired end state. Thus, in order to successfully achieve their goals, the 160th must employ the best technical equipment to supply their soldiers with a greater probability of success. So the question becomes, how can the 160th maintain a higher level of

¹ David Tucker and Christopher J. Lamb, *United States Special Operations Forces*, New York: Columbia University Press, 2007, 148-149.

technically superior weapon platforms than not only those of their adversaries, but also to distinguish themselves from those of the conventional Army?

The need for the modernization of the helicopters within SOF is evident in the aging fleet that is currently being operated. The primary aircraft that are operated by the 160th include variants of the H-47 Chinook, the H-60 Blackhawk, and the H-6 Little Bird. All of these aircraft have been in production since the 1970s.² Although these aircraft have undergone multiple upgrades throughout the past decades, they are not representative of the current technology, and the emerging technology that is available in the commercial industry.³ If the 160th SOAR, or any other special operations unit in the U.S. military, is to maintain their technological advantage over their adversaries, then modernization must be addressed more thoroughly and possibly through other innovative ways.

At a time when the need for replacing the aging aircraft fleet is present, the U.S. military is currently involved in what has commonly been called the Global War on Terror. Beginning with the fateful day of September 11, 2001, the military has been in an ongoing war against multiple terrorists groups such as Al Qaeda and the Abu Sayaff Group. This shift in focus of the military from fighting in a conventional war, with characteristics such as armor versus armor units and clearly delineated front lines

2 Congressional Research Service, "Military Helicopter Modernization: Background and Issues for Congress," By Christian F.M Liles and Christopher Bolkom, Washington, D.C.: Government Printing Office, 2004, 1.

3 Center for Strategic and International Studies, Special Operations Forces Aviation at the Crossroads, Washington, D.C., September 2007, 10.

of maneuver, to fighting insurgents and individual terrorists should reflect a need Army-wide in the weapons platforms that are needed to conduct the new style of war fighting. On May 13, 2008, Defense Secretary Robert Gates described his vision for the military and future war fighting.

Much of what we are talking about is a matter of balancing risk: today's demands versus tomorrow's contingencies; irregular and asymmetric threats versus conventional threats. As the world's remaining superpower, we have to be able to dissuade, deter, and, if necessary, respond to challenges across the spectrum.... Nonetheless, I have noticed too much of a tendency towards what might be called "Next-War-itis" - the propensity of much of the defense establishment to be in favor of what might be needed in a future conflict. This inclination is understandable, given the dominant role the Cold War had in shaping America's peacetime military, where the United States constantly strove to either keep up with or get ahead of another superpower adversary.... But in a world of finite knowledge and limited resources, where we have to make choices and set priorities, it makes sense to lean toward the most likely and lethal scenarios for our military.... I believe that any major weapons program, in order to remain viable, will have to show some utility and relevance to the kind of irregular campaigns that, as I mentioned, are most likely to engage America's military in the coming decades.⁴

The views expressed by Secretary Gates could be interpreted as reinforcing the need for the 160th SOAR to

⁴ "Secretary Gates Speech," Department of Defense, May 13, 2008. <http://www.defenselink.mil/speeches/speech.aspx?speechid=1240> (accessed September 10, 2008).

reevaluate their aging aircraft fleet and begin to determine what new technology could help to better prepare them for the current and future wars involving the U.S.

The problem with trying to determine the type of technology that will best be used in future wars is having the correct intelligence analysis to determine what will provide the greatest effect on the outcome of the war. The guidance by Secretary Gates has helped to alleviate some of that confusion. However, as it will be shown in Chapter III of this paper, having the proper guidance to determine the best future weapon may not necessarily be the best process to actually acquiring the right equipment. The problem lies in research, development, and implementation process. Designing a new aircraft around specific requirements can be costly and time consuming. By the time that the aircraft is finally developed, the intelligence that originally informed the design of the aircraft may no longer be of use. The question then becomes how does a military go about developing new technology if it may become obsolete by the time of its full production?

The answer to this question may be similar to the controversial statement made by Former Secretary of Defense Donald Rumsfeld when he said, "We go to war with the weapons that we have."⁵ This statement is not far from the truth, except maybe the answer should have reflected that we have not properly adopted our doctrine to best employ the latest technology that has been developed. The history of Army Aviation may point to some of the problems that have been

⁵ Mike Mount, "Troops Put Thorny Questions to Rumsfeld," CNN, December 9, 2004. <http://www.cnn.com/2004/WORLD/meast/12/08/rumsfeld.troops> (accessed September 1, 2008).

encountered by the Army when trying to develop new aviation weapon platforms. Historical evidence may indicate that previously developed technology has better served the aviation community in times of conflict instead of trying to develop non-existent technology.

The goal of this research is to conduct a qualitative analysis using the case study methodology to examine the process of innovation when using current developed technology vice developing an aircraft based on specific future requirements. First, the history of Army Aviation will be examined in order to understand the evolution that has taken place in Army Aviation concerning the various types of aircraft that have been employed. Second, the concept of innovation will be explored and the success and failures in the aviation community will be evaluated. Finally, a look at the role of innovation in Army Special Operations Aviation (ARSOA) will be conducted. The relative infancy of the 160th SOAR⁶ allows this comparison with the conventional army and affords the ability to apply the lessons learned to the operations of the 160th. The results of this paper will try to develop a concept in the application of innovation which should be capitalized on by the Army's special operations aviation unit.

⁶ The 160th SOAR was officially commissioned in 1981. When compared to the lifespan of the conventional Army aviation, the special operations unit is relatively new. Fred J. Pushies, *Night Stalkers: 160th Special Operations Aviation Regiment (airborne)*, St. Paul, MN: Zenith Press, 2005, 10.

II. HISTORY OF AVIATION

The effects that innovation and technology have had on warfighting have been tremendous. The 20th century essentially moved warfare from the two dimensional perspective on the ground to a third dimension in the sky. A review of the major changes that have happened since the inception of Army Aviation can highlight not only the dependency that aviation has on technology, but also a correlating change of doctrine within the Army. The shifts in Army Aviation that will be portrayed are the rise of the hot air balloon, the invention and integration of the airplane and the helicopter, and finally, the invention of the turbine engine and its utilization in the helicopter. These four events mark major milestones which eventually lead to the creation of the 160th SOAR.

A. HOT AIR BALLOONS

The official birthday of the current Army Aviation branch did not occur until 12 April 1983; however, many historians link its heritage back to the late 1800s.⁷ Hot air balloons marked the first steps in the development of air doctrine. The first military use of the balloon in the U.S. was demonstrated by Thaddeus Lowe on 21 July 1861. The purpose of the flight was to conduct aerial observation during the battle of Bull Run.⁸ Later that year, the Balloon Corps was established as a reconnaissance unit for

⁷ "U.S. Army Aviation: A Proud Past," *Army Aviation Museum*, Jan 2, 2003. <http://www.armyavnmuseum.org/history/past3.html> (accessed November 31, 2008).

⁸ James W. Williams, *A History of Army Aviation: From Its Beginnings to the War on Terror*, New York: iUniverse, 2005, 11.

the military. However, the lack of knowledge in the full fledged capabilities in the balloon led to the Balloon Corps demise approximately one year after inception.

The resurrection of the hot air balloon occurred a few years later by the Army's Signal Corps. The balloon was used as an effective tool for not only conducting aerial observation but also in transmitting messages to the commander's in the field. This could be considered one of the first uses of airborne command and control and helped to reignite interest in the air war.

B. POWERED FLIGHT

The first powered air platform (the airplane) indicated a radical change in the operational capabilities of the Army. The use of aerial platforms had already been established by the use of the hot air balloon in the Spanish-American war. The Army now had its sights on the first practical airplane. The first flight by the Wright brothers in 1903 would signify this change. Unfortunately, it was not until four years later when the Army began to realize the potential of the airplane. In 1908, the Wright brothers demonstrated their invention to a board of officers from the Signal Corp and governmental officials to include President Theodore Roosevelt.⁹ The test flight was a huge success meeting all of the requirements that the Army believed it needed.

⁹ James W. Bradin, *From Hot Air to Hellfire*, Novato, CA: Presidio Press, 1994, 50.

The air services branch of the Army was formally established in 1914.¹⁰ Utilization of the airplane to support the troops of the ground had finally taken hold. The airplane was seen as the wave of the future and was increasingly becoming a priority for the military. The strategic and tactical importance of the airplane was being developed and eventually championed by Col. Billy Mitchell. Mitchell understood the tactical importance of the airplane in its ability to support the troops on the ground. He also understood the strategic and operational importance in the future of bombing missions. The bombing missions are what eventually became the focus of the Army Air Force and would ultimately become the catalyst for the separation between the Army and its Air Corps.

C. THE HELICOPTER

During the quick rise of the airplane, a lesser known air platform was also being developed, the helicopter. The concept of the helicopter has roots that go as far back as DaVinci with his drawings of a screw type rotor.¹¹ However, DaVinci's drawing never made it any further than the drawing board. The necessary engineering practices were not available, not to mention the internal combustion engine.

The first practical attempts of the helicopter were pursued by various inventors to include Louis and Jacques Breguet, Paul Cornu, and Etienne Oehmichen.¹² Igor

¹⁰ James W. Bradin, *From Hot Air to Hellfire*, 1994, 51.

¹¹ "Pioneers: The Beginning." *Helis*, <http://www.helis.com/pioneers/> (accessed November 31, 2008).

¹² Tony Landis and Dennis R. Jenkins, "Lockheed AH-56A Cheyenne." *Warbird Tech Series*, Vol. 27, Specialty Press Publishers and Wholesalers, 2000, 9-10.

Sikorsky, a Russian immigrant to the United States, ultimately produced the first true helicopter that was practical. The year 1939 became a milestone in the future history of Army Aviation, when he developed the VS-300, a helicopter design that utilized the anti-torque rotor on the tail of the aircraft which allowed the helicopter the ability to hover, a feat which clearly distinguished this new type of aircraft from any others.¹³ The success of this helicopter piqued the interest of the U.S. Army and in 1941 the Army received its first YR-4, an adaptation of the VS-300.

The helicopters of the 1940s and the 1950s had very limited capabilities. The piston driven engine coupled with the available metallurgy practices of the time reduced characteristics such as airspeed and payload. Despite these limitations, the helicopter saw plenty of action in the Korean War. The results of the Korean War and the employment of the helicopter by the Marines for emergency troop lifts began to grease the wheels (or skids) for further utilization of the helicopter. But for this to occur, new strides in technology would first have to take place.

D. TURBINE ERA

The invention of the gas turbine engine by Sir Frank Whittle in 1930¹⁴ set the stage for a radical advancement in the field of rotary-wing aircraft. This engine would require less maintenance than the piston type, increased the

¹³ Tony Landis and Dennis R. Jenkins, "Lockheed AH-56A Cheyenne," 2000, 10.

¹⁴ NASA. Ultra Efficient Engine Technology, <http://www.ueet.nasa.gov/studentsite/engines.html>, (accessed December 1, 2008).

power to weight ratio, and was much simpler to operate than previous engines.¹⁵ The first helicopter to be flown with a turbine engine was the Kaman K-225 in 1951. Coincidentally, three years later, Major General James Gavin wrote an article "Cavalry, and I Don't Mean Horses," which expounded upon the idea of using helicopter as a means to creating highly mobile ground forces.¹⁶ Gavin's idea was now possible with the use of the turbine engine powered helicopter which increased the helicopter's airspeed and payload capability.

The Howze Board of 1962 was the final ingredient that cemented the helicopter's role in the Army. The findings of the board recommended the creation of an Air Assault division which would be based around the UH-1 Huey helicopter.¹⁷ The Huey was the first turbine engine helicopter that the Army procured and boasted a cruise speed of 110 knots and a maximum speed of 120 knots.¹⁸ It was the speed of these aircraft that allowed for the concept of air mobility to be realized. The Huey helicopter would later become known as the "backbone... of the army's helicopter fleet."¹⁹

15 Piston engines required manual operation of the throttle by the pilot which affected the rotor speed. The turbine engine operated with the use of a governor which helped to regulate rotor RPMs. In James W. Williams, *A History of Army Aviation: From Its Beginnings to the War on Terror*, 2005, 65.

16 J.A. Stockfisch, *The 1962 Howze Board and Army Combat Developments*, Santa Monica, CA: RAND, 1994, 8.

17 James W. Williams, *A History of Army Aviation: From Its Beginnings to the War on Terror*, 2005, 66.

18 J.A. Stockfisch, *The 1962 Howze Board and Army Combat Developments*, 1994, 19.

19 James W. Bradin, *From Hot Air to Hellfire*, 1994, 104.

E. CREATION OF ARMY AVIATION SPECIAL OPERATIONS

In late 1979, a group of U.S. hostages were taken prisoner by a group of Iranian students at the U.S. embassy. After months of negotiation by the Carter administration, a plan was developed that would utilize the country's newest asset, Delta Force. This mission, named Operation Eagle Claw, was deemed so secret that even the members of the force were only vaguely familiar with the other units that were participating in the operation. It has been claimed that at their first link up point, named Desert One, some of the members would meet each other for the first time.²⁰

The aviation portion of the plan turned out to be the weak point in the operation. There were many different variables that were used to determine which type of aircraft was to be used and which military branch the pilots were to come from. Ultimately, the Navy's RH-53D was selected due to its extended range fuel tanks and payload capability. The pilots who were chosen to fly the mission were from the Marines based upon their perceived ability to conduct ground assault type missions.²¹ The decision to mix and match aircraft and their respective pilots was one of the first indications of poor planning and coordination. Difficulties were encountered on the infiltration route due to poor weather, a lack of anti-aircraft weapons intelligence, and poor technology. After six of the eight aircraft arrived at Desert One, an additional aircraft was deemed unable to continue due to a faulty hydraulic system.

²⁰ Lucien S. Vandenbroucke, *Perilous Options: Special Operations as an instrument of U.S. Foreign Policy*, New York: Oxford University Press, 1993, 158-159.

²¹ Ibid., 124.

At this point, the mission was aborted and arrangements were made to exfiltrate the force. As the aircraft were repositioning to depart, a helicopter collided with a C-130 transport aircraft leaving 8 Americans to die in the Iranian desert. A congressional investigation that later took place found that lack of coordination and planning was a key element in the failure of Operation Eagle Claw.²²

After the fiasco at Desert One, an Army helicopter task force was immediately constituted. These aircraft were gathered from the 101st Aviation Group, which had seen extensive action while deployed to Vietnam. These aircraft and their pilots began to train extensively in the desert, near Yuma, Arizona, while using night vision goggles in order to fly a proposed follow on mission in Iran.²³ The second mission never took place; however, the foundation for the 160th SOAR had been laid.

The missions that the 160th has been involved in include everything from insertion of Special Forces members for special reconnaissance (SR) missions, to rescue missions, to providing close air support. The first mission that the 160th conducted was part of Operation Urgent Fury in Grenada. The 160th was involved in at least three portions of the operation. They were tasked with inserting a SEAL team for the purpose of securing a radio transmitter, inserting another SEAL team to conduct an assault on the Governor-General's Mansion, and assaulting the Richmond Hill Prison to secure senior advisors of the Revolutionary

²² Lucien S. Vandenbroucke, *Perilous Options: Special Operations as an instrument of U.S. Foreign Policy*, 1993, , 128-132.

²³ Fred J. Pushies, *Night Stalkers: 160th Special Operations Aviation Regiment (airborne)*, St. Paul, MN: Zenith Press, 2005, 14-15.

Military Council ²⁴. The Richmond Hill Prison mission did not occur as planned due to the extreme amount of enemy fire that was encountered when the aircraft were approaching the prison and was subsequently aborted. The other two missions were accomplished with varying degrees of success.

Operation Desert Storm provided the first opportunity for the entire Regiment to be deployed. Many of the missions conducted by the 160th involved insertions of Special Forces for SR missions. A new mission assumed by the 160th involved the locating and destroying of the infamous SCUD missile. A modified MH-60 Blackhawk, called a direct-action penetrator (DAP), was used in this endeavor. This aircraft had the ability to be armed with either hellfire missiles or stinger missiles, whichever was needed for the mission, and gave the 160th a more robust firepower than it had previously held.

Operation Gothic Serpent in Somalia is probably one of the more well known operations conducted by the 160th. Conducted in October 1993, the 160th was the aviation component of Task Force Ranger. Although this operation clearly showed some shortcomings of the special operations community, it displayed the wide range of capabilities possessed by the 160th. During this operation, the 160th inserted Delta members using the MH-6 Little Bird, inserted Rangers using the MH-60 Blackhawk, and provided close air support to the ground forces with the AH-6 Light Attack Helicopter.

²⁴ Fred J. Pushies, *Night Stalkers: 160th Special Operations Aviation Regiment (airborne)*, 2005, 36-38.

The creation of the 160th was the result of multiple procedural and technological innovations. Since its inception, the 160th has continued to hone both their skills in aviation operations to include nap-of-the-earth flying²⁵ techniques while using night vision goggles. Their motto, "Night Stalker's don't quit," is emblematic of their pursuit in perfection.

²⁵ Nap-of-the-earth flying is a flying technique where the helicopter is flying at altitudes of 0-40 ft above ground level.

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III. AVIATION TECHNOLOGICAL INNOVATION: SUCCESSSES AND FAILURES

A. INNOVATION AND THE MILITARY

The goal for any military is ultimately to have the capabilities to defeat enemy combatants when called upon, whether it is for the purpose of the defense of the homeland, to aid in the survival of an allied nation, or in more modern times, to defeat the goals of international terrorism. The U.S. Army has presumably strived to maintain this goal of achieving victory by adapting to the ever-changing battlefield. These adaptations have come in many forms, whether they are in the organizational design of the various units or the technology that is needed to have the tactical advantage over their opponents. The technological adaptation or attempt thereof, is what is of concern in this section of the paper, specifically, the Army's ability to adapt to the changing needs and ever growing field of aviation technology. The conflict in aviation is whether the pursuit of existent technology or emerging technology should be undertaken. An example of this conflict could be described as the decision to invest and pursue an undeveloped aircraft design or should an aircraft that has already been tested and evaluated primarily in the civilian sector be acquired then modified as needed for military application. First, some terms and ideas that govern the concept of innovation will be discussed along with the relationship of innovation with the military. Next, a look at Army Aviation's track record in attaining the perceived

necessary changes in technology will then be discussed followed by a summary and review of the successes and failures that have been attained by the aviation branch.

Army Aviation is a branch that is closely tied with technology that is either presently available or attainable. It is this relationship that requires the Army to constantly seek out, either through internal research and development programs, or external private companies, the latest and most advanced forms of technology. These new technologies are often referred to as either inventions or innovations. The Organization for Economic Development describes innovation as the "implementation of a new or significantly improved product" and a product innovation as "the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses."²⁶ Innovations, or the products thereof, can often be the driving force behind new military doctrine. Although this at first may seem counterintuitive, a quick explanation should be made. The common process that drives the need for new weapon systems should be the strategic necessities as determined by the National Security Strategy. This strategy should, in the best way possible, try to determine the types of future conflicts. Using this knowledge, military leaders should either try to determine if their current inventory of weapon platforms are capable of completing the forecasted mission requirements or if a new weapon is required. However, as one very well knows, trying to develop a weapon for long term future utilization is probably only possible if they have a crystal ball that truly works. Martin Van

²⁶ Organization for Economic Co-operation and Data, *Oslo Manual: Guidelines for Collecting and Interpreting Innovative Data*, OECD Publishing, 2005, 46.

Crevelld notes that "during the twentieth century, too, none of the most important devices that have transformed war... owed its origins to a doctrinal requirement laid down by people in uniform..."²⁷ Utilizing this logic, the idea could then be presented that if doctrine doesn't necessarily drive military innovation, then it could be possible that military innovation affects doctrine. New innovations in the arena of Army Aviation have demonstrated this effect time and time again, such as the cases of the AH-56 Cheyenne and the infamous RAH-66 Comanche. Why is it that the developments of new platforms initially sanctioned by the Army have failed? The lessons and insights that can be learned from the conventional Army's track record should provide insight to the effective use of innovation when concerned with the acquisition of new aircraft.

In the field of technological innovation, there are some principles that may help to guide and determine the importance of innovation in Aviation operations. Everett M. Rogers describes a diffusion of innovation theory that may help to determine why some of the projects sanctioned by the Army never took off. The theory divides the beneficiaries of innovation into five groups, the innovators, the early adopters, the early majority, the late majority, and the laggards.²⁸ After conducting a study Rogers determined that the number of people that readily fell into the most important group here, the innovators, was only 2.5 out of 100. This begs the question then, how is a large

²⁷ Martin Van Crevelld, *Technology and War: From 2000 B.C. to the Present*, New York: The Free Press, 1991, 220.

²⁸ Everett M. Rogers, *Diffusion of Innovations*, New York: Free Press, 2003, 283-285.

bureaucracy, like the military, supposed to be expected to readily consume new innovations and maintain the patience needed to see a project through to completion? The answer may be in the form of a maverick. Mavericks can play an integral role in the foundation of an organization when it comes to innovation. Billy Mitchell may well be one of the more famous mavericks associated with Army Aviation.²⁹ Using the diffusion of innovation theory, then, it may be important for the military to actually embrace these mavericks, or free thinkers, when it comes to Army Aviation. This approach is only one of the possibilities to curb institutional sluggishness in obtaining the proper aircraft for future wars. The initial problem of obtaining the aircraft through the correct process still persists.

The sources of innovation in the military can be broken down into two broad categories, the commercial sector and internal research and development. The commercial sector, the primary supplier for aviation development, may often be funded by the Department of Defense, but there are also cases where a company has developed technology from their own financial resources to win a military contract in the future or simply to improve their aerospace toolkit. The "dual use" of aviation products (commercial and military) often provides additional incentive for technological advances.³⁰ In fact, the Army has often been better served

²⁹ Billy Mitchell was a military aviator who supported the strategy of airpower amid staunch military opposition.

³⁰ Allan R. Millett, "Patterns of Military Innovation in the Interwar Period," In *Military Innovation in the Interwar Period*, by Williamson Murray and Allan R. Millett, 329-368. Cambridge: Cambridge University Press, 1996, 348.

by capitalizing on these advancements made by private companies instead of trying to design an aircraft destined only for military use.

The success and failures of technological innovation can be found throughout the history of Army Aviation. To help display how these processes have worked in the past, several cases will be looked at to include: the AH-56, the RAH-66, OH-13, COL Vanderpool's team, and finally the Direct Action Penetrator maintained by the 160th.

B. AH-56 CHEYENNE

The new practice of conducting assaults through the use of helicopters during the Vietnam War was a doctrine that was essentially being baptized by fire. During the course of the initial air assaults, it was discovered that the air convoys consisting of utility helicopters were in need of an armed escort. One of the primary requirements for this armed helicopter was speed. The CH-47 Chinook had an airspeed of up to 170 knots which was too slow to be accompanied by a fixed-wing aircraft and too fast for an armed UH-1 which operated at an airspeed of 120 knots. In order to address this problem, the Army sent out a request for proposal (RFP) to the commercial industry to develop an aircraft that was capable of speeds that were commensurate with the Chinook. Of the twelve companies that pursued the requirement, two stood out above the rest, Sikorsky with the S-79 and Lockheed with the XH-56. On November 3, 1965, Lockheed was awarded a contract to develop and produce their

aircraft designated by the Army as the AH-56.³¹ The AH-56 was revolutionary in design. The advantages of AH-56 lay in its sleek airplane-like fuselage, advanced suite of avionics, wings, but most importantly, a push-type propeller that was attached to the rear of the aircraft. The rear propeller, combined with the stub wings, allowed the helicopter to reduce the lift requirements of the main rotor, which in turn, allowed the aircraft to reach speeds up to 215 knots.³² After seven years of development and testing, the aircraft never reached the full production stage because of a vibration in the main rotor.

The criticism of the AH-56 program is that the helicopter was discarded too early due to politics.³³ Ironically, in 1973, Lockheed had fixed the vibration problem in the Cheyenne, one year after Congress had cancelled the program. The Cheyenne could have been the Army's most technologically advanced aircraft in the fleet had they utilized patience and fully understood the future implications of its utilization. However, the Army can't be completely faulted as the original intended use of the Cheyenne was to escort utility helicopters conducting air assaults in the Vietnam War. By the time that the Cheyenne had finally come close to fruition the immediate need for an armed escort helicopter had dissipated with the withdrawal from the Vietnam War.

31 Tony Landis and Dennis R. Jenkins, "Lockheed AH-56A Cheyenne," *Warbird Tech Series*, Vol. 27, Specialty Press Publishers and Wholesalers, 2000, 20.

32 Tony Landis and Dennis R. Jenkins. "Lockheed AH-56A Cheyenne," 2000, 81.

33 Frederic A. Bergerson, *The Army Gets an Air Force: Tactics of Insurgent Bureaucratic Politics*, Baltimore: The Johns Hopkins University Press, 1980, 64.

The Cheyenne aircraft is an example of Army Aviation attempting to build a helicopter from non-tested technology. The current doctrine that was being developed, air assaults, had determined that a new type of aircraft was needed to fill the void. Since there was not an aircraft yet developed that was fast enough to stay with the Chinooks, the Army decided to develop one on their own.

C. RAH-66

Technology in the 1980's and the 1990's had opened up new windows of opportunity for the Army to develop a new aircraft. Attempting to capitalize on this era, the development of the RAH-66 Comanche commenced. The RAH-66 was to be the most advanced aircraft of its time utilizing stealth technology to reduce its radar signature and advanced avionics and weapons packages which would increase its lethality and durability. The RAH-66 was originally designed to be a multi-mission air platform. Initial proposals for the Comanche included utility and reconnaissance variants with the option to develop an attack variant.³⁴ After a revision in the program, the utility variant was cut from the program focusing the Comanche primarily on the reconnaissance role of Army Aviation. Ultimately, after multiple revisions to the program, the Comanche was destined to replace the OH-58 Kiowa Warrior and supplement the AH-64 Apache.³⁵

³⁴ Congressional Research Service, "Army Aviation: The RAH-66 Comanche Helicopter Issue," By Christopher Bolkom, Washington, D.C.: Government Printing Office, 2003, 1.

³⁵ Ibid., 3.

The Comanche aircraft program was discontinued in 2003. After over 20 years of developing new technology, conducting multiple tests and evaluations, and investing \$7 billion into the program, the Comanche program was determined to be too costly to reach full production along with no longer being relevant to the needs of Army Aviation.³⁶ The successes of the Kiowa and the Apache in the Gulf War of 1991 and Operation Enduring Freedom revalidated each of those aircraft's effectiveness. The money saved from cutting the program allowed aircraft upgrades to be made to the Army's existing fleet. Once again, an attempt at designing a new aircraft failed. The positive side to this venture was the application of the technology derived from the Comanche and applying it to the target systems of the Apaches. Yet, the process of acquiring a new helicopter airframe still seems to be elusive.

D. OH-13 SIOUX

One example of a successful venture in aircraft acquisition comes in the form of the OH-13. During the 1940s, Larry Bell, the founder of Bell Helicopters, had recognized the increased opportunity in the aviation industry for the utilization of helicopters in the U.S. military. Moving forward with this insight, Bell Helicopters began on their path of innovation and developed through their own financial resources the Bell Model 30.³⁷ Building on this model, with the help of Arthur Young, Bell Helicopters later went on to produce the Bell Model 47 in

³⁶ Congressional Research Service, "Army Aviation: The RAH-66 Comanche Helicopter Issue." By Christopher Bolkom, 2003.

³⁷ James W. Bradin, *From Hot Air to Hellfire*, 1994, 80.

1945.³⁸ The Model 47 was destined to be one of the first actively deployed helicopters by the U.S. Army. In 1946, after displaying the capabilities of the Model 47 to the Army, the Army procured 13 of these helicopters and was later given the designation of OH-13.³⁹

The OH-13 is probably most famous for its service during the Korean conflict. Known as the "Angel of mercy," the OH-13 evacuated more than twenty one thousand wounded soldiers.⁴⁰ The OH-13 was a simple airframe that had been developed by the commercial industry primarily through the insights of its founder, Larry Bell, and the designer Arthur Young. The initial design of this aircraft did not involve any tedious requests directly from the Army as far as design specifications. Even though the helicopter was built in the civilian industry, the Army was able to capitalize on the OH-13's technology and utilize the aircraft, with few modifications, to serve a significant role in the Korean Conflict. Innovation in this context was best served by the Army adopting new technology from the commercial industry and adapting its capabilities to existing doctrine, in this case, emergency evacuation.

38 "Bell Timeline," *Helis*, <http://www.helis.com/timeline/bell.php>, (accessed November 16, 2008).

39 Howard A. Wheeler, *Attack Helicopters: A History of Rotary-Wing Combat Aircraft*, Baltimore, MD: The Nautical and Aviation Publishing Company of America, 1987, 19.

40 James W. Bradin, *From Hot Air to Hellfire*, 1994, 87.

E. COLONEL VANDERPOOL'S TEAM

The conflict between the Air Force and the Army over the role of close combat support⁴¹ helped to ignite the process of innovation in the Army aviation community in the development of what should be called its first attack aircraft. The ground forces of the Army had begun to feel that the Air Force was not committed to its mission of providing close air support.⁴² In order to rectify this perceived deficiency, General Hutton, the commandant for the Army's Aviation School, had decided to use Training Directive Number 13 as a loophole to explore the possibilities of arming current Army helicopters.⁴³ Pursuing this venture, Gen Hutton employed the talents of Colonel Jay Vanderpool, Chief of the Combat Developments Office, to explore the realm of arming helicopters. Vanderpool, a non-aviation officer, readily accepted the challenge, first by consolidating a group of men that had skills in metal fabrication, and secondly, by contacting the helicopter manufacturers to determine the strength and weaknesses of the airframes. During 1956 and 1957, Vanderpool's initiative had proved to be revolutionary. Successful

41 The memorandum of Understanding of 1951 placed restrictions on the capabilities of Army Aircraft. The Army was to only use its aircraft for air reconnaissance, command and control, aerial wire laying, and the transportation of supplies. The Army was instructed to not duplicate any of the missions that were already being performed by the Air Force such as assault transport, close combat support, or interdiction. In Richard P. Weinert Jr., *A History of Army Aviation: 1950-1962*, Fort Monroe, VA: Office of the Command Historian, 1991, 20.

42 James W. Bradin, *From Hot Air to Hellfire*, 1994, 92.

43 "Memorandum No. 13... emphasized the need for new concepts in mobility and flexible organization...", in Richard P. Weinert Jr., *A History of Army Aviation: 1950-1962*, 1991, 160.

weapon's firing had been demonstrated utilizing the OH-13 with .30 caliber and .50 caliber machine guns.⁴⁴

Successful innovation took place in this scenario because of the initiative of two officers, Gen Hutton and Col Vanderpool. Due to their loose interpretation of a training memorandum, these two innovators were to set the stage for the era of the attack helicopter. The important point to notice in this instance is that the only new technology that was developed in this case was the mounts that held the weapons to the airframe. The OH-13 Sioux had already been in production for over 10 years at the point of test firing weapons. New technology wasn't developed in the face of a requirement but was converted to be utilized to meet the Army's need.

F. DIRECT ACTION PENETRATOR (DAP)

The final case study involves the Army's special operations aviation unit. Probably one of the greatest utilization of innovation by the 160th SOAR comes in the form of the Direct Action Penetrator (DAP). The DAP is a modified MH-60 Black Hawk that has been outfitted with various different types of weapons including 2.75 folding-fin aerial rockets, a 30mm chain gun, and a .50 caliber Gatlin gun.⁴⁵ The idea for arming the Black Hawk is attributed to Cliff Wolcott, a member of the 160th SOAR. Wolcott was part of the Systems Integration and Management Office (SIMO) which manages the integration of "a new weapon

⁴⁴ James W. Bradin, *From Hot Air to Hellfire*, 1994, 97.

⁴⁵ Fred J. Pushies, *Night Stalkers: 160th Special Operations Aviation Regiment (airborne)*, St. Paul MN: Zenith Press, 2005, 99-100.

or nav[sic] system" on the 160th's aircraft.⁴⁶ The first true test of the DAP came during the Gulf War where the DAP was used as a scud hunter and is credited with obtaining the first confirmed helicopter kill of a scud.⁴⁷

The innovation behind the DAP involved the "retooling" of existing technology to fill a perceived void in capabilities. The DAP provided the 160th with an armed helicopter that could "fly low at night, go long distances and survive better than any helicopter."⁴⁸ Instead of pursuing a completely new airframe with untested technology, the 160th was innovative in their endeavors to utilize what was readily available.

G. INNOVATION APPLIED

These four case studies supply a broad overview of the successes and failures of innovation in Army Aviation. Generally, the successful procurement of new helicopters has often been the result of the acquired helicopter already having been tested and evaluated in the commercial sector. Current aircraft in the Army's fleet that fit this mold include the OH-58 Kiowa Warrior which was based on the Bell Model 206 and the CH-47 which is a derivative of the Model 107, which was later modified into the model 114. The examples of the first attempt to arm a helicopter by Col Vanderpool and later the arming of the Black Hawk helicopter by the 160th were accomplished by using previously proven

⁴⁶ Michael J. Durant and Steven Hartov, *In the Company of Heroes*, New York: G.P. Putnam's Sons, 2003, 162.

⁴⁷ Ibid., 300-301.

⁴⁸ "Special Operations Forces Reveal Armed Black Hawk Helicopter," *Defense Daily*, April 3, 1995, <http://proquest.umi.com> (accessed November 5, 2008).

technology and adapting that technology to fit the mission requirements. Attempts to build new airframes such as the AH-56 and the RAH-66 required radical new technology that had yet to be proven in the commercial industry. The foresight to build new technology was well intentioned by Army Aviation, but the lesson to be learned is that "commercial off the shelf" (COTS) products are just as adaptable to current mission needs and require less time to be put into production.

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IV. ROLE OF INNOVATION IN AVIATION SPECIAL OPERATIONS

A. FOCUS OF TECHNOLOGY

A special operations unit should be "specifically organized, trained, and equipped to conduct and support special operations."⁴⁹ Maximizing the capabilities of the equipment and exploiting new innovations helps to provide Special Operations (SO) with a greater tactical advantage over their adversaries. The 160th SOAR has strived to maintain their uniqueness with their specially selected and trained pilots and some of the most technologically upgraded aircraft. The problem remains though, how long can upgrades to an aging aircraft fleet continue to keep the 160th ahead of the competition? In the evolving global stage of conflict, the aircraft currently employed by the 160th represent those that were crucial and successful during the Cold War. As it has been referenced earlier, the new war is against terrorism and insurgency. "Long term success rests on the ability of the U.S. and its allies to deny terrorist organizations the sources of power that sustain their efforts." ⁵⁰ This change in focus could be seen as a need

⁴⁹ Director for Operational Plans and Joint Force Development, *Department of Defense Dictionary of Military and Associated Terms*, Washington, D.C.: U.S. Government Printing Office, 2001.

⁵⁰ U.S. Special Operations Command. "Operations and Maintenance, Defense Wide Budget Activity 01," http://www.defenselink.mil/comptroller/defbudget/fy2008/fy2007_supplemental/FY2008_Global_War_On_Terror_Request/pdfs/operation/03_SOCOM_%20Supp_OP-5.pdf, (accessed November 10, 2008).

for a change in the aircraft fleet, or at least a portion of it, to help SO aviation maintain their special edge over those of their contemporaries.

The path to achieving this edge lies in technological innovation and Army Special Operations Aviation's (ARSOAs) ability to capitalize upon it. In order to explore this idea, a review of what drives the missions of SO will be examined and correlated to the requirements that should be on their aircraft. Second, a discussion of Major Force Program 11 (MFP-11) will take place to examine its impact on the abilities of SO to innovate. Finally, a look at how the 160th has fared in the past with innovation and the obstacles that they must overcome will be provided.

B. CORE TASKS

The primary missions that special operations forces are responsible for are referred to as core tasks and include "direct action, special reconnaissance, foreign internal defense, unconventional warfare, counterterrorism, counterproliferation of weapons of mass destruction, civil affairs operations, psychological operations, and information operations."⁵¹ These tasks are not necessarily designed to be conducted by any one unit but they help to inform individual units of the requirements, such as training and equipment that they should employ to be successful. The history of 160th's missions as described in Chapter Two, indicate that they often act in the realm of direct action and counterterrorism missions. In the current

⁵¹ Joint Staff Directorate. *Joint Publication 3-05: Doctrine for Joint Special Operations*, Washington, D.C.: Government Printing Office, 2003, II-3.

environment, as SOCOM spearheads the campaign against terrorism, a reconfiguration of the aircraft of the 160th should be pursued to operate in the role of counterterrorism. The current aircraft that the 160th employs such as the MH-60 Blackhawk and the MH-47 Chinook are good aircraft for inserting special operators into non-permissive environments, but the capability to increase the 160th's efficiency may lie in their requirements for a more specialized aircraft. Characteristics such as increased speed coupled with a lower probability of detection would seem to be the linchpin for successfully targeting terrorists in a non-permissive environment.

C. FINANCING TECHNOLOGY

The approach taken by ARSOA in technological innovation primarily rests on the integration of new technology into existing platforms. The reasons for this approach are varied but have been attributed to the wording of MFP-11. MFP-11 was established in 1987 to provide "the [Special Operations] Command with funding authority for the development and acquisition of equipment, materials, supplies, and services peculiar to special operations. Legislation makes the military services responsible for providing standard equipment and supplies to their forces assigned to unified combatant commands." ⁵² The standard equipment, in the case of the 160th, could refer to something as small as a hand-held survival radio up to an entire airframe. Most of the aircraft operated by the 160th

⁵² "Special Operations Forces: Force Structure and Readiness Issues." *Global Security*, March 24, 1994, <http://www.globalsecurity.org/intell/library/reports/gao/hsi94105.htm> (accessed November 1, 2008).

are currently operated by the conventional army and are thus referred to as "service common". The Little Bird, the only aircraft solely operated by the 160th, was previously used by the conventional army, but was replaced by the OH-58 Kiowa Warrior. Reasons for the dual use of aircraft by conventional and special units of the Army include reduced costs for aircraft research and development (R&D) and the reduction in logistical requirements. To exploit the intent of MFP-11, the services have primarily used the funds for upgrades to the aircraft in order to enhance their capabilities beyond those of the conventional forces.

Exploiting emerging technology and innovations has been key in the 160th's ability to maintain a technologically advanced aircraft fleet. The production of the DAP by the 160th is a great example of innovation. Another example includes the introduction of an advanced warning system in the 2000s which was later adapted by the conventional army.⁵³ Also in 2000, a new rotor system was developed for the H-6 Little Bird to decrease rotor noise and increase stability. The list of upgrades for the aircraft is long and continuous and has generally helped to provide advantages to the 160th's capabilities. The current plans in ARSOA include more upgrades to the avionics and navigation systems and aircraft survivability systems.⁵⁴ However, despite all of these upgrades, the 160th still maintains an aircraft fleet that has its roots in the Vietnam Era.

⁵³ Congressional Research Service. "Military Helicopter Modernization: Background and Issues for Congress." By Christian F.M Liles and Christopher Bolkom, Washington, D.C.: Government Printing Office, 2004, 4-7.

⁵⁴ Ibid., 4.

D. OBSTACLES TO INNOVATION

Mention of the obstacles faced by the Special Operations Aviation community in obtaining a truly specialized aircraft should be made. Developing a brand new aircraft for the Army requires a relatively large financial investment in the research and development phase of the program, sometimes accounting for up to 15 percent of the entire program.⁵⁵ The final cost per aircraft could range anywhere from nine to twenty four million dollars, depending on the number of aircraft that are ultimately procured. The Army's aviation acquisition programs are designed to procure aircraft for the entire Army which maintains approximately 3500 rotary wing platforms to include the helicopters of ARSOA which account for approximately 180 aircraft. The high cost of aircraft, including the research and development, combined with the tradition of utilizing service common aircraft, make it difficult for ARSOA to procure their own aircraft. However, today's highly technological commercial industry, which has the incentive to invest their own finances into R&D, helps to offset some of the total costs of an aviation program. The corresponding cost savings, combined with the small numbers of aircraft that would be procured solely by special operations, may indicate that a helicopter designed for the sole use of Special Operations may be a practical goal.

⁵⁵ Percentage derived from table 1-2 in Congressional Budget Office. *Modernizing the Army's Rotary Wing Aviation Fleet*, Washington, D.C., November 2007, 5.

The implementation of MFP-11, designed to procure equipment peculiar to special operations, has partially stymied the potential for future innovation in Special Operations. The onus of procurement remains with the conventional Army which reduces the initiative of ARSOA. Nevertheless, the small size of the 160th could allow opportunities to perfect new and untried techniques and technologies by an organization that employs some of the best aviators add the Army. The role of innovation in Aviation Special Operations should not be limited merely to upgrades of existing Army inventory, but should also attempt to incorporate new emerging aircraft from commercial industry that have the potential to meet the current and future doctrinal needs of ARSOA.

E. TIME FOR CHANGE

The need and opportunity for a new aircraft specifically designed for Special Operations is present. The importance and fluidity of the environment where SOCOM is taking the lead on combating terrorism presents the opportunities necessary to begin changing the approaches to innovation. Applying technological upgrades to legacy aircraft has worked well in the past. The aircraft fleet of the 160th has up until now, been able to keep up with requirements for their missions. But, as pointed out previously, military units have difficulty in adopting new tactics based upon old technology. Rotary wing technology has advanced significantly over the past twenty years. Sikorsky has recently unveiled a new model which boasts

cruising speeds of up to 250 knots.⁵⁶ This type of aircraft could have implications on the ways that the 160th conducts their missions. A faster special operations helicopter could facilitate a faster response time and the ability to react to real time intelligence resulting in the increased efficiency to capture or kill designated terrorists or insurgents. Other advantages of a faster, more technologically advanced helicopter could include a decrease in reaction time by the potential targets and a quicker self deployment timeframe which may reduce interagency dependency. Incorporating a fresh new technologically advanced aircraft into the fleet of ARSOA could force a change in doctrine that is better adapted for fighting in an unconventional war against terrorism and insurgents.

⁵⁶ "Sikorsky's X2 TECHNOLOGY™ Demonstrator Achieves First Flight," *Sikorsky*, August 27, 2008, http://www.sikorsky.com/sik/about_sikorsky/news/2008/20080827_1.asp (accessed November 21, 2008)

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V. CONCLUSION

Innovation is spontaneous, dictates a level of uncertainty, and can be difficult to manage. Trying to determine the best weapon platform for future wars is difficult. It took the Army four years following the invention of the aircraft to realize the value that it would add to warfighting. Bell helicopters designed a helicopter well ahead of the Army even realizing that it needed rotary wing platforms. The ability to manage these innovations requires flexibility and the ability to incorporate new technology into an organization and understand if a change in doctrine as a result of new innovations can reap benefits in the present and future.

So how does a military develop new technology if it will become obsolete by the time it reaches full production? The case of the Comanche helicopter exemplifies this point. After multiple years in development and a price tag of almost \$7 billion, the Comanche program never entered the final phase of production. Investing in these programs is not necessarily a bad idea. The technology that was gained from the program benefited the other attack aircraft of the Army's fleet, even though the Comanche program was ultimately cancelled. Instead of trying to build a new helicopter, maybe the investments should be in the components of a helicopter in which commercial industry could develop on their own helicopters for ultimate military use.

The Army has been most successful in procurement of helicopters when the final product was already in production by the manufacturer. Van Creveld discussed the notion, as noted earlier, that no new major platforms had been designed from a doctrinal requirement laid out by people in uniform. The commercial industry has incentives to produce new equipment all the time. By improving upon their designs, the commercial product becomes more marketable to not only the military but to the civilian sector as well.

It's not that special operations should not seek to develop new technology, but rather it seems more prudent to invest in better understanding the current technology and better applying it to the current doctrine. If the conventional army wants to keep funding the development of new aircraft, the special operations community would be better off further developing doctrine for new technology and efficiently incorporating it into the fight for the future.

The Army's Special Operations Aviation fleet of aircraft is aging. The basic airframe designs date back to 1960s and 1970s and have, except for multiple avionics and navigational upgrades, remained unchanged. In order to meet the requirements of the current and future wars, new technology needs to be employed in order to maintain a technological advantage over their opponents.

Unfortunately, ARSOA is subject to the Conventional Army's historical track record of innovation. Recall that in Chapter Three the examples showed how innovation when applied to complete airframes has largely failed when an aircraft was designed around non-existent technology. The

successes in innovation either came from utilizing an airframe that had already been largely tested by the commercial sector or through smaller scale innovations involving the adaptations of weapons to an existing Army helicopter.

The limitations of ARSOA in capitalizing innovations would appear to come from the legislation that was passed to create MFP-11. The funds needed to develop a new aircraft can quickly reach astronomical proportions as seen with the RAH-66 Comanche. Also, the time used to develop an aircraft can act as a deterrent in finally achieving the complete product. As with any new development, problems can occur with the design, and if time is not present and patience wears thin, then the program may ultimately be cancelled as it was with the AH-56 Cheyenne.

The small size of the 160th lends itself to innovation, and should be the driver of policy change within aviation as a whole. Remember that true innovators comprise only 2.5% of the whole as stated by the theory of diffusion of innovation. The total SOCOM aircraft fleet is 5% of the entire Army suggesting that maybe this organization is the best place to look for innovation. Instead of developing a new aircraft, the conventional army should use the 160th as a test bed for an aircraft that is already in development. This group has already demonstrated its ability to completely modify an existing aircraft and apply it to its missions, as it so skillfully did with the MH-60 DAP. Instead of looking for technology that is still beyond the horizon, the goal should instead be to integrate existing

technology, primarily a commercial aircraft in development, into the current doctrine and modify both the doctrine and aircraft to serve new needs.

Wars are not caused by technology, but technology can affect the methods in which war is fought. Innovation in the future should be pursued in technology that is currently in use. The applicability of it may not be fully understood until it has been fully explored. Attempting to predict the future is useful, but fully recognizing what is currently available, in the commercial sector, could possibly change the ways that missions are conducted and answer the question of "why didn't we think of that before?"

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