Flesh and Blood:
The Call for the Pilot in the Cockpit

Lt Jeff Mustin, USAF

> One of the most significant military lessons of the Vietnam War was that control of the air over an enemy's homeland must be wrested from him by men specifically trained for that purpose. On the face of it, that would sound like a redundant statement. After all, hasn't the same lesson been learned from all the previous wars of the twentieth century? Of course it has, but recent technological preoccupations somehow seem to have blinded us to the importance of the man in the cockpit, and to the fact that air-to-air combat boils down to the man and his tactics against the other man and his tactics. (Drendal, …And Kill MiGs, 1997)

During Desert Storm, CNN painted a picture of warfare that revolutionized combat. Images were etched in the public's mind of smart weapons slicing through chimneys and Maverick missiles guiding their way through the night to kill tanks. Removed from this picture were humans. The flesh and blood of the war were distinctly absent from these images, and it painted a subconscious image of sterility that was in stark contrast to the Vietnam War 20 years prior. This image, to an extent, had to be intentional. Generals who had won their spurs in the jungles of Southeast Asia, many of whom were still haunted by the ghosts of that war, anticipated high death tolls similar to Vietnam. The generals learned their lessons in Vietnam. During the Gulf War, in an effort to win the hearts and minds of civilians back home, they ensured the press would have little access to actual battlefields. In hindsight, it is possible the plan backfired.

What the public saw was a war of machines, computer chips, and laser beams fighting their way through the Baghdad sky. They also saw a military victory with a margin incomparable in modern times. To top it all off, they also viewed very little loss of life. We used machines, and won big, without many losses. Machines must have worked. They must be the answer.

The logic seems clear enough, but the fatal flaw is that perhaps perception is not reality. Americans have always had an infatuation with technology, from hot cars to cell phones, and the love of those gadgets made the perception that much easier to internalize. The fact, however, is that pilots dropped all those bombs. An amazing 93% of the bombs that fell from the skies in Desert Storm were "dumb" munitions, guided only by pilot's skill with none of the precision-guided glory that filled television screens nationwide (Boyne, 1997, p. 312). Humans, not machines, fought Desert Storm, and their training in the technology, not the technology itself, won the war.

The technological revolution showcased in Desert Storm has done anything but slow down. The past decade has seen a substantial increase in vast amounts of technology, from precision-guided munitions such as the Joint Direct Attack Munition (JDAM) and Joint Standoff Weapon (JSOW) to integrated INS/GPS layouts in aircraft navigation. One of the most intriguing new technologies to come to the public eye is uninhabited aerial vehicles, or UAVs. UAVs have played some role in military aviation since before World War II whether it was as a target or spy plane. The U.S. government began to implement them on a more regular level during Vietnam under a highly classified project called Buffalo Hunter. UAVs did battle damage assessments (BDA) after B-52 raids during Operation Linebacker, obtaining images of SA-2 sites in North Vietnam, and photographing Soviet helicopters in Vietnam (Jones, 1997, p. 10). It was the UAVs operation during Desert Storm, however, which attracted the most attention. There are two potential reasons for this. First, politicians and battlefield commanders alike began to identify the need for casualty-free war. Secondly, the technological success of Desert Storm initiated what is tantamount to a technology fetish throughout the Pentagon and the halls of Congress.

After Desert Storm, UAVs were once again utilized in warfare over the skies of Bosnia, and the pro-UAV momentum has been rising ever since. Recently, Boeing unveiled the new X-45, a prototype unmanned combat aerial vehicle (UCAV) that will use robotic logic to deploy weapons on the battlefield (Kandebo, 2000, pp. 30-31).

Unmanned aerial vehicles and UCAVs have received increasing levels of attention in recent times, and many Americans believe that UAVs and UCAVs will fight the next war. Comparisons have been made to the early airplanes. Initially, when airplanes were designed, they were attached to the Army. Army leadership did not know how to manage and leverage aircraft capabilities, so they limited them to scout and patrol roles. Eventually, some creative pilots took guns and grenades with them in the cockpit and employed them by hand. The fighter aircraft was born.

The analogy to modern UAVs are not hard to miss. UAVs are a new technology that current leadership does not quite know how to harness. First relegated to reconnaissance roles, now ambitious engineers are mounting weapons on them. Is the next generation of fighter aircraft being born before our eyes? For the sake of the United States, we can hope that it is not. To understand fully why UAVs will not change future aerial combat, and could in fact hinder operations, we must first look to the past.

Technology and warfare has always been a debatable topic. The only sure factor is that the progression of warfare technology always leads to effective and economical counter–technologies or tactics. From the dawn of humanity, humans have always sought for better weapons than their enemies. The initial encounter thousands of years ago is not hard to envision. A hungry caveman eyes a saber-toothed tiger for food. The Neanderthal sneaks up and hits the carnivore with his bare fist, only to be devoured. The other cavemen, watching the carnage, realize they need help. They get the biggest sticks they can find, and subsequently ambush and kill the tiger. The cavemen, over dinner, quickly determine their club was the key to success. Thus, man’s quest for better weapons could reasonably be predicted.

This same cycle has been paralleled throughout the history of warfare. Take the Middle Age knight, for instance. Highly trained and highly paid, he was a lone ranger noted for both his armor and valor. It required years of apprenticeship and training to become a knight, and the price was heavy (not unlike modern day pilots). The invention of the crossbow changed all this. With one swoop, a common farmer armed with a crossbow could topple a mighty knight with impunity. How could this be? This was considered so disgraceful that the Church of England attempted to outlaw the crossbow. In 1139, Pope Innocent II declared the crossbow "hateful to

God and unfit for Christians" (Brodie and Brodie, 1973, pp. 35-37). The mighty knight, with all his training and bravado was rendered a harmless target by the cycle of technology in combat.

Another excellent example of this technology cycle is radar. During World War II, radar was developed to detect approaching airplanes, and it proved worth its weight in gold during the Battle of Britain. The early warning of approaching airplanes allowed the beleaguered British Spitfire and Hurricane pilots to save gas by knowing exactly when and where the attack was coming. When the fight was upon them, they could focus their planes, concentrate firepower, and provide a huge advantage against the Luftwaffe (Brodie and Brodie, 206).

Since the advent in radar, it had been the primary method of detecting aircraft. This subsequently led to planners realizing that techniques to defeat radar were needed. Over the decades to follow, many electronic countermeasures (ECM) systems were developed to avoid radar detection, to include chaff, various forms of jamming, bin masking, terrain bounce counter-radar, Crosseye and Crosspol deception, and radar decoys. (Stimson, 1998, 454-455) Not to be outdone, Electronic Counter Countermeasures (ECCM) such as detection and angle tracking, passive ranging, reduction of ground clutter and sidelobe interference, beam forming, broadband multi-frequency operation, and sensor fusion were invented to reestablish the dominance of radar as a primary means of detection (Stimson, 468).

When the United States launched the Have Blue program in the 1970s that yielded the F-117, they changed the radar detection paradigm. Modern times have shown that even the F-117, however, is not invincible or invisible to radar. In fact, antiquated radars with lower pulse repetition frequencies (PRFs, around 250Hz to 4000 Hz) are rumored to have shown better success at picking up stealthy aircraft (Stimson, 335-345). Other technology in development is rumored to be able to detect stealth aircraft. Some ideas have included technology, similar to that used in weather satellites, which would detect molecular motion in the atmosphere, and hence could identify airplanes flying. While this technology is very expensive and not readily available, the potential still exists to render stealth designs very visible.

Radar represents the classic example of how technology breeds counter-technology. A lesson lies in this cycle: **technology, although crucial to modern combat, always has weaknesses**. This is a truly ominous statement for UAVs, which are completely reliant on technology and datalink, but the truth in the statement reveals the inherent weakness in the vehicles.

It is important to note that the technology itself is not the lethal variable. Instead, it is the reliance thereof that lends itself to failure. Defense contractors will not admit those limitations; technology breeds money, and money is their livelihood. It is natural that in their marketing strategy regarding the capability of UAVs, the manufacturers would not advertise their weaknesses. These weaknesses must be identified in military circles to avoid the reliance on technology that could prove disastrous. One of the best examples of this failure lies among the ghosts of Vietnam.

> "The United States has a strategy based on arithmetic. They question the computers, add and subtract, extract square roots, and then go into

> action. But arithmetical strategy doesn't work here. If it did, they would already have exterminated us with their airplanes".
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> - Gen. Vo Nguyen Giap CINC, N. Vietnamese Forces (Guilford, Postmodern War, 160).

Prior to Vietnam, Secretary of State Robert S. McNamara was quoted as saying the days of aircraft flying with guns are over. He assumed, as many others did, that the advent of the missile in the 1950s would render aircraft guns as merely ballast. This led to the development of the "Century Series" fighter aircraft: the F-102, F-106, and the F-4, to name a few. None of these jets in their original form carried guns, and they were designed with high-wing loading, which inhibits dogfight-style turning (Franks, 1998, p.175). These jets were intended to carry missiles in a high-speed, high technology, nuclear war. These same systems struggled with the low intensity Vietnam battlefield.

High-speed missiles would have been appropriate in the skies of WWII, with huge formations of fighters and bombers trouncing through the sky. When the Vietnamese, flying highly maneuverable MiG-15s and MiG-17s, realized that some U.S. fighters (in particular the F-4) were armed only with missiles, they opted to close as quickly with the planes as possible, forcing the Americans into turning fights and slicing inside the minimum ranges of missiles. They attacked our inherent weaknesses and our reliance on missile technology. Consequently, U.S. Fighters were helpless due to their lack of basic weaponry.

> "… Fighting a MiG with a gunless F-4 is like fighting a guy with a dagger when he has a sword, or maybe vice-versa. A fighter without a gun, which is the most versatile air-to-air weapon, is like an airplane without a wing. Five or six times, when I had fired all my missiles, I might have been able to hit a MiG if I'd had a cannon…" - Col. Robin Olds (Franks, 178).

Col. Fredrick "Boots" Blesse, author of the famous "No Guts, no Glory" text on aerial combat, was the Deputy Commander for Operations for the 366th TFW at the time, and came up with the idea to mount a 20 mm gunpod on the centerline of the F-4. The 366 TFW and subsequently shot down four MiGs (The wing is known as the "Gunfighters" to this day for their exploits) (Drendal, 1997, p. 79). Lesson learned, the F-15 and F-16, and later the F-22, were all designed with an internal cannon. Although the USAF learned the specific lesson never to design a fighter without a gun, they have not applied the broader lesson that systems designed with inherent reliance on technology are (or soon will be) invariably vulnerable in a combat environment.

To reiterate, the problem was not with carrying missiles. Missile technology began to come to light in Vietnam, and the U.S. scored dozens of kills with them. Any suggestion that because MiGs found a way to counter the "little skinny wingman" we should no longer carry them misses the point. It is the logical equivalent of the idea that we should stop installing radar on aircraft because stealth aircraft have been invented. The problem lies within the lack of a backup to the missile. The past has demonstrated that any technology has a weakness that when substantially relied upon equals combat deficiencies.

> "Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after those changes occur" Guilio Douhet, 1922 (Davis, 1).

Historical examples do not bode well for the future of UAVs. A look at future combat does not exacerbate the situation. First of all, the battlespace of the future will most likely differ from the open warfare of Desert Storm and World War II. The United States is powerful enough to intimidate potential enemies into seeking other advantages by hitting us at our weaknesses or using terrain to counter our might. Two perfect and recent examples of this scenario would be the U.S.S Cole and Mogadishu, Somalia. The Cole clearly demonstrated we are extremely vulnerable when our guard is down. It also showed that despite extreme cost and technology, even the U.S. best weapons are very vulnerable to small, affordable, attacks. Somalia could also provide a view of the future. Airpower was shown to be extremely vulnerable when operating in urban environments against a very low-technology enemy. Indeed, intelligence assets deem that the urban, and potentially littoral conflicts will be our primary military threat as a nation. The decision is derived from demographics.

By the year 2025, 80% of the world's population will reside in third world nations. Due to the inconsistent ability of these countries' rural regions to support a population explosion, people tend to turn to the cities for resources and shelter. As a result, third world cities are anticipated to see a population increase of 50%, and some third world cities will have a population density 10 to 25 times greater than Washington, D.C. (Davis, 1-2). This drastic increase in population growth is also expected to yield unrest and turmoil due to food and water shortages. An increase in population and unrest provides tinder for flames of war to ignite, similar to the situation in Mogadishu (Davis, 2-4).

The urban environment presents a difficult playing field for any commander. Utilizing UAVs will prove no different. Line of sight guidance could prove next to impossible with the high buildings and cluttered streets. Most UAVs can revert to guidance through satellite relays, but this function takes up much more of the UAV's memory while also presenting susceptibility to jamming. Relays with small observation aircraft have been utilized but still remain vulnerable (Jones, 1997, 28-42).

Weather will affect the capability of UAVs. The smog generated in most cities can create haze layers that drastically reduce pilot visibility. Furthermore, littoral environments are renowned for having inclement weather. Many UAVs use electro-optical/ infa-red (EO/IR) guidance to present imagery to the user. During Desert Storm, weather denied the use of PGMs guided by those same EO/IR systems up to 30% of the time. The electro-optical and infa-red systems could not see through clouds or received false readings (Langford, 1995, 1). Synthetic aperture radar could most likely overcome these deficiencies, but its radiated signals can also make the UAV openly visible, and an easy target.

GPS-guided munitions such as the JDAM and JSOW were supposed to solve the weather problem. When used in the latest bombing of Iraq, the GPS guidance proved fallible. Aviation Week and Space Technology reported 12 of 14 bombs missed badly, and hinted some of the error was due to Iraq jamming the signals (Fulghum, 2001, p. 25). Most circles have concluded that the error was due to a glitch based on programming error, which is understandable with the probable millions of lines of code. Getting a 1 and a 0 mixed up in binary would not be difficult. Any handheld GPS user understands GPS accuracy varies with time and satellite reception. At the very least, this makes strikes with GPS munitions predictable, and at the worst makes them ineffective. How many more times will simple errors embarrass the combat capability of the United States?

The final word on relying on computers for accuracy lies within Desert Storm itself. During the Gulf War, manned F-117s with pilots dropping weapons were 10 times more accurate than Tomahawk cruise missiles operating unmanned and autonomously, while carrying four times the payload. Although the systems are similar, the distinct difference in accuracy can be attributed to having a pilot on board (Hallion, 1992, p. 250).

Another frightening aspect of UAVs that has not been addressed much is its substantial logistics trail. To deploy a Predator UAV in theater, it requires five C-130s, two C-141s, or one C-17/C-5 airframe and 28 personnel. The total system cost is $28.3 million, about the same as a single seat F-16A when first designed (Jones, 1997, p. 31).

This is not a number to be taken lightly. Deploying a UAV anywhere leaves a huge "footprint" and requires a logistics trail at least equal to that of a modern manned combat force. A manned aircraft can fly across the ocean, deploy out of several bases, and has the wherewithal due to human intelligence to adjust profiles in flight. In contrast, it cannot be overlooked that once deployed, UAVs, such as the Predator, must remain under constant control of the operating facility, and return to that facility or perish. Although UAV such as Global Hawk are becoming more autonomous, the ground support network is still substantial. This creates a kind of "electronic tether" that paralyzes mobility in aerial warfare and violates a basic tenet of airpower (G. Desch, personal communication, 2001).

The most paralyzing aspect of UAVs is what the threat we cannot yet see. China is rumored to be working rapidly on a space capability. Will it allow them to jam our satellites? Russia is continuing to sell military secrets in an effort to bolster their economy. The United States has many global enemies, some with vast financial resources. Which one will determine how to jam our UAV signals to render the remote vehicles useless? It is simply a matter of time until the technology pendulum swings and UAVs are neutralized.

This is not to say that UAVs do not have a place in military circles. They can provide excellent imagery and have loiter times that far exceed human limits. They can be made small enough to fit in a backpack, and then released in that same urban environment to provide eyes and ears to an infantry platoon. They can be excellent force multipliers. What they cannot be, however, is the backbone to the combat effectiveness of the United States. If they are essential, when the enemy takes them out, we have lost our ability to fight. If they are not essential, then we step to "Plan B" and continue to take the fight to the enemy.

It is a simple choice, really. UAVs, although they hold promise for future combat, are extremely vulnerable assets. To rely on them as the sole method of performing SEAD missions or BDA would simply be foolish. Pilots still must be trained and properly equipped to execute these missions. Relying only on UAVs to do so places no less than the combat capability of the United States at stake. History has shown us that technology will be compromised. The only way to overcome this inherent weakness is to have a fighter pilot in the cockpit, with eyes on the target, finger on the trigger, and flesh and blood in harm's way.

References

Boyne, Walter J (1997). Beyond the Wild Blue: A History of the U.S. Air Force 1947-1997. New York: St. Martin's Press.

Brodie, Bernard and Fawn M. Brodie (1973). From Crossbow to H-Bomb: The Evolution of the Weapons and Tactics of Warfare. Bloomington, In.: Indiana University Press.

Davis, Jon M., Maj. (1995). Urban Offensive Air Support: Is the United States Military Prepared and Equipped? Graduate Research Project presented to Marine Corps Command and Staff College, Quantico, Va.

Drendal, Lou (1997). …And Kill MiGs: Air to Air Combat from Vietnam to the Gulf War. Carrolton, Tx.: Squadron/Signal Publications.

Franks, Norman (1998). Aircraft Versus Aircraft: The Illustrated Story of Fighter Pilot Combat from 1914 to Present Day. New York: Barnes & Noble Books.

Fulghum, David A., John D. Morrocco, and Robert Wall (2001, February 26). Strikes Hit Old Targets, Reveal New Problems. Aviation Week and Space Technology. p. 25.

Gray, Chris Hables (1997). Postmodern War: The New Politics of Conflict. New York: The Guilford Press.

Hallion, Richard P. (1992). Storm Over Iraq: Air Power and the Gulf War: Air Power and the Gulf War. Washington: Smithsonian Institution Press.

Jones, Christopher A. (Mar 1997). Unmanned Aerial Vehicles (UAVs): An Assessment of Historical Operations and Future Possibilities. Graduate Research Project presented to Air Command and Staff College, Maxwell AFB, Al.

Kandebo, Stanley W. (2000, October 2). Boeing Premieres UCAV Demonstrator. Aviation Week and Space Technology. pp. 30-31.

Langford, Stephen A., Capt. (1995). Future Developments in Conventional Weapons. Graduate Research Project presented to USAF Weapons School, Nellis AFB, Nevada.

Spick, Mike (1997). Fighters at War: The Story of Air-to-Air Combat. New York: Barnes and Noble Books.

Stimson, George W. (1998). Introduction to Airborne Radar: 2nd Edition. Mendham, New Jersey. SciTech Publishing, Inc.