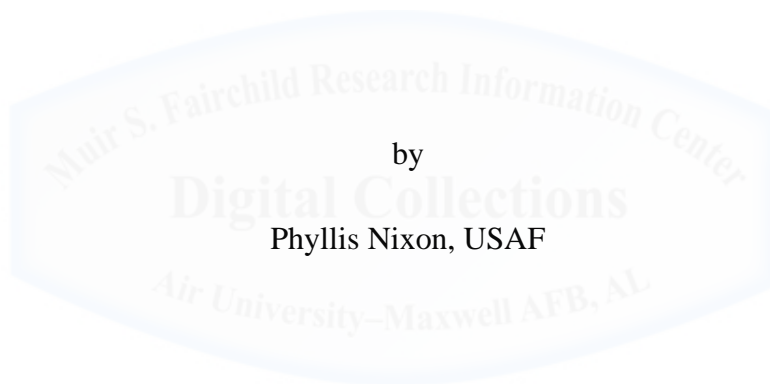


AU/ACSC/2016

AIR COMMAND AND STAFF COLLEGE

AIR UNIVERSITY

**DECEIVING THE ENEMY:  
THESE ARE THE DRONES YOU ARE LOOKING FOR**



A Research Report Submitted to the Faculty

In Partial Fulfillment of the Graduation Requirements

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June 2016

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## **ACKNOWLEDGEMENTS**

First and foremost, I would like to thank God because without him it would have been utterly impossible for me to complete this paper but with God, I know everything is possible. Also, I would like to thank Dr. Heather Marshall and Dr. Chris Johnson for your invaluable time, attention and advice without which I would not have been able to complete this thesis. Additionally, I would like to thank my classmates for taking the time to provide critical comments on the topic and the paper. I have to thank my son and daughters for your understanding and giving me the time needed for conducting the research. Finally, I would like to express my thanks to my husband for his constant support, encouragement, assistance, and patience which has been extremely valuable.

## **ABSTRACT**

Tactical Deception (TD) has always been a critical part of warfare, and it can still be a decisive factor today, especially through the use of physical deception that relies on Unmanned Aerial Vehicles (UAVs). This paper examines how the military can more effectively employ Unmanned Aerial Vehicles (or “drones”) in a TD role by using physical deception to execute both aviation and ground combat missions more adequately. This thesis will use the problem/solution framework to examine the issues of aircraft vulnerability in the low altitude flight regime and downed aircrew capture, both areas which have not benefited significantly from advancements in military technology and tactics. Physical deception UAVs, which deceive the “eyes and ears” of the adversary rather than electronic systems, are analyzed as alternatives for these two operational areas. The analysis determines physical deception UAVs can be beneficial in decreasing risk to air and ground combatants during mission execution by causing adversaries to expend resources, delay their reactions, or react incorrectly to tactical situations. The research recommends the development and fielding of two specific types of physical deception UAVs, the “Mission Wingmen” UAV and the “Shootdown” UAV.

## SECTION 1. INTRODUCTION

In August 2011, a US CH-47 Chinook helicopter began its descent in a remote corner of Afghanistan to insert elite Special Forces soldiers at an important objective. Unseen by the aircrew or US reconnaissance drones, a Taliban operative fired a Rocket Propelled Grenade (RPG) at the landing Chinook aircraft, causing it to lose control and crash, killing all 38 service members on board. The nighttime crash marked the “worse single-day loss of American life since the beginning of the Afghan war” at the time.<sup>1</sup>

This situation could be prevented through the use of creative tactical deception relying on UAVs. In this scenario, the Taliban operative—still unknown to US forces—remains hidden. He watches multiple helicopters overfly his position and start decelerating to land in areas near him, in numerous directions. A more vulnerable helicopter catches his eye as it attempts to land. With deadly accuracy, he fires his RPG and destroys it with a single rocket shot. Yet not a single life is lost. The enemy has only destroyed an unmanned, half-size variant of an actual Chinook helicopter. This drone helicopter was one of twelve drone helicopters accompanying three manned helicopters, which successfully deployed the US soldiers at the desired objective. This is an example of an UAV, or drone, performing a physical deception role in combat by deceiving an adversary’s “eyes and ears” at an opportune time. Unfortunately, on the actual night in 2011 in Afghanistan, these types of deception drones had not been envisioned.

To date, the primary deceptive role of UAVs has been in electronic deception, such as deceiving the radar of an adversary’s integrated air defenses into believing the unmanned aircraft were manned attack aircraft during the opening of an air campaign. This was exemplified by the Israeli Air Force in 1982 as well as the United States Air Force in 1991.<sup>2</sup> These tactics caused the adversary to expend surface-to-air missiles against deceiving drones. While electronic



deception will continue to be an important role for UAVs in future conflicts, the maturation of UAV deception is warranted.

One aspect of deception for which modern UAVs have not been developed or used effectively for is in the physical realm of deception. As described in the scenario above, this entails fooling the actual human “eyes and ears” of an adversary, rather than their electronic radar and tracking systems. UAVs can operate in hostile environments with minimal risk to personnel and can deceive and increase the "fog of war" against opponents of the US military with innovative and effective physical deception methods. Since 2001, the US has mostly faced opponents lacking any air defense capability beyond small arms and unguided rockets. Still, these “technologically-limited” opponents in Iraq and Afghanistan inflicted losses against many US aircraft.

Operations that require an enemy individual’s direct visual observation and orientation to perform, such as aiming a weapon by eyesight, are ideal targets for physical deception UAVs. In particular, two areas related to air combat missions will benefit. One is increasing the survival rate of combat aircraft, such as helicopters, that conduct low-altitude operations in the range of the enemy and are susceptible to low-technology weapons such as small arms. Another is increasing the probability of recovering downed aircrew in enemy controlled areas by enhancing the confusion and reaction of enemy individuals and their command structure.

Most literature concerning military UAVs highlights their use in the electronic deception role, matching their historical use in aerial campaigns. Lance Winslow (2007) argues UAVs can perform deception by fooling sensors operated by an adversary and, regardless of modern-day defenses, a UAV might still effectively penetrate them directly to a target.<sup>3</sup> His research highlights the ability of UAVs to spoof even the most advanced air defenses, especially if a

UAV's capabilities are tailored to deceive specific sensors used by adversaries. Likewise, UAVs could be used to disrupt the enemy's reaction and understanding during tactical operations, thereby increasing the enemy's "fog of war." Similarly, Lt Col David Glade (2000) states UAVs could be used to jam fire-control radars and be employed as decoys emulating the radar, infrared, and radio signatures of fighter aircraft to increase manned aircraft survivability.<sup>4</sup> Maj Ronald McGonigle (1993) argues the use of UAV electronic decoys in tactical operations is an excellent example of joint force multipliers, and their use reduces losses to aircrew and manned aircraft.<sup>5</sup> Although he approaches the topic from the angle that UAVs are cost-effective and reduce risk to human operators, these are also qualities which make UAVs an ideal platform for deception operations. These research examples demonstrate that intellectual opinion on UAV use in tactical deception is in the electronic deception role, not in physical deception, and is focused on deception operations in contested air environments against "near-peer" militaries.

By developing UAVs for physical deception roles to shape an adversary's ability to visually observe and orient to situations. The US military can better execute combat missions against the range of future adversaries, from nation-states to insurgents, by decreasing risk to air and ground combatants during mission execution by causing adversaries to expend resources, delay their reactions, or react incorrectly to tactical situations.

The military can more effectively employ Unmanned Aerial Vehicles (UAVs or "drones") in a TD role by using physical deception to execute both aviation and ground combat missions more adequately. This can ensure higher success rates for both air and ground combat missions by confusing adversaries and causing them to expend resources, delay their reactions, or react incorrectly. Modern UAV development for deception roles has demonstrated their primary use as an electronic decoy target, emulating manned aircraft to cause confusion and

leading adversaries to expend air defense resources, such as during the initial strikes against an Integrated Air Defense System (IADS). While this has been successful, the maturation of UAV development into yet unseen physical deception roles can provide additional benefits to US military operations in other scenarios, such as protracted ground-centric combat campaigns. These recent US conflicts against insurgents in Iraq and Afghanistan largely did not involve operations against modern air defenses, but still entailed the loss of 70 US aircraft and 145 military personnel demonstrating vulnerabilities in some mission areas have not been overcome by advanced technology, including the survival rate of combat aircraft that conduct low-altitude operations and the recovery of downed aircrew in enemy controlled areas.<sup>6</sup>

This paper will use the problem/solution framework to address how the military can more effectively employ UAVs in a physical TD role. The paper will provide background information on tactical deception use in combat operations along with the benefits of getting inside an adversary's decision-making cycle and reaction ability. Current capabilities and use of UAVs will be examined. Next, after a discussion on vulnerabilities and limitations of air operations that may benefit from tactical deception UAVs, deception alternatives in the physical realm with UAVs will be explored. After analyzing the potential effects of tactical deception UAVs on an adversary's resources, reactions, and situational awareness, the paper will conclude with recommendations for implementation.

## SECTION 2. BACKGROUND

### Deception in Combat

Tactical deception has been used since the dawn of warfare to create the “fog of war” for an adversary. As defined, tactical deception is creating uncertainty in the enemy to gain an agile advantage in combat operations.<sup>7</sup> One of the first notable examples of deception against US forces occurred during the Civil War, when the Confederate army’s Major General Magruder created decoy cannons from tree trunks to display to the advancing Union army. This ruse caused the Union army’s General McClellan to delay an attack for over a month, believing the Confederate forces were better equipped than his forces.<sup>8</sup> Other historical examples of tactical deception occurred during World War II when the Soviets drew upon their military doctrine known as *Maskirovka*, which included camouflage as a deception tactic.<sup>9</sup> The Soviets found camouflaging tactics involving dummies and decoys deceived the enemy effectively in many ways, and they also used *Maskirovka* to conceal massive troop movements and create false knowledge to confuse the enemy. For example, the Soviets often created fake vehicle tracks, which created an illusion of military activity in an area.<sup>10</sup> Many nations drew upon similar capabilities, such as fielding dummy aircraft, trucks, tanks, and aircraft hangars to deceive enemy observers at opportune times.

Similarly, during D-Day when the US military landed in Normandy, France on June 6, 1944, the Allied military forces fooled the Nazis into believing that they were not coming.<sup>11</sup> They had built a fake army, inflatable tanks, trucks, as well as fake track marks which feigned troop movement.<sup>12</sup> Also, fake radio communication about a massive military strike to Normandy was transmitted. Finally, during the assault, allied forces launched dummy paratroopers from

aircraft to deceive German forces. This gave the enemy a false impression of the direction of Allied troop movement, causing German leadership to reallocate their forces to repel a deployment of “dummy” paratroopers.<sup>13</sup> The success of this deception tactic enabled Allied forces to more safely deploy to their true location. While the allies were setting up the inflatable distraction, the military was lined up across the sea.<sup>14</sup>

These time-tested tactics of physically fooling an adversary still play a role today, even with the advent of modern weaponry and sensors. Some believe deception is minimized in US tactics today due to the US “way of war” of using overwhelming military force to destroy enemy capabilities during military campaigns.<sup>15</sup> Effective tactical deception, however, always ensures the most efficient execution of military missions regardless of military superiority. In addition, recent conflicts have demonstrated even less advanced opponents can still cause lethal impacts to the military. Today, with the development of relatively low-cost UAV technologies, deception techniques should be implemented against all opponents. David Acosta, in his research on the 2006 Israeli-Hezbollah conflict, examined the effective use of visual deception by Hezbollah in deceiving the Israeli military with fake bunkers, while developing a significant ammunition and weapons bunker system in secret.<sup>16</sup> Regarding deception, he surmises, “While often misunderstood and underutilized, if used properly, the returns on the small amount invested can be enormous.”<sup>17</sup>

### **UAV Development and Capabilities**

UAVs have existed since the beginning of the American Civil War when an unmanned balloon carrying explosives was developed. Further UAV development emerged by 1883 with the beginning of aerial photography.<sup>18</sup> Reconnaissance roles soon emerged with the development of a UAV with a kite, camera, and a string used as shutter release. The US used this device in

1898 during the Spanish-American War, resulting in one of the first military aerial reconnaissance pictures.<sup>19</sup>

Testing and development of different radio-controlled unmanned aircraft continued throughout World War I, with several countries experimenting with explosive-laden aircraft.<sup>20</sup> The V-1, an unmanned flying bomb developed by the Nazis, targeted nonmilitary targets during World War II. This particular UAV could reach a speed of almost 500 miles per hour and could carry up to 2,000 pounds of explosives and travel up to 150 miles. During this time, the V-1 killed 900 civilians and injured 35,000.<sup>21</sup> The Allies also experimented with UAVs as a weapon, outfitting a remotely-controlled B-17 bomber with explosives to strike enemy targets. Although never fully successful in shaping overall combat direction, these developments foreshadowed the subsequent maturation of UAVs.<sup>22</sup>

Between 1965 and 1975, the US operated an extensive amount of UAVs during the Vietnam Conflict, flying approximately 3425 UAV reconnaissance missions at high and low altitude.<sup>23</sup> In fact, reconnaissance UAVs took about 85 percent of the photographs used for battle damage assessments. The National Reconnaissance Office (NRO) provided the organization and structure through which the Air Force, as well as the Central Intelligence Agency (CIA), developed UAVs during this period.<sup>24</sup> The US also implemented one of the first uses of UAVs as electronic decoys, when specially developed Lightning Bug decoy drones accompanied other reconnaissance drones, causing enemy SAMs to target the decoys. Although successful, the enemy radar operators soon understood the deception tactic causing the termination of the program.<sup>25</sup> By 1970, technology allowed for control of UAVs from ground stations, rather than airborne aircraft, and this allowed for more robust control and mission effectiveness.<sup>26</sup> In 1974, the Air Force received responsibility for all UAV development, funding, and operations from the

NRO.<sup>27</sup> However, within a few years, cost overruns in UAV development programs coupled with concerns with UAV survivability against Soviet forces ceased many major UAV development efforts in the Air Force budget.<sup>28</sup>

During the first Persian Gulf War, the United States acquired Pioneer UAVs from Israel.<sup>29</sup> Also, as illustrated in Figure 1, UAVs operated in a major deception role when BQM-74 Scathe Mean Drones flew missions in loose formations to simulate inbound bombers attacking Basra and Baghdad during the initial stages of the aerial campaign. The Iraqi missile operators, seeing these apparently valuable targets approaching, operated their targeting radars to engage the “bombers” and were instantly targeted and destroyed by US anti-radar weapons.<sup>30</sup> Although successful, as occurred in Vietnam, future adversaries studying previous engagements will likely anticipate this tactic and develop countermeasures. Additionally, some adversaries may wish to selectively engage aircraft rather than attempt full-scale engagement of a superior air capability during the opening stages of an aerial campaign. This was demonstrated during the Kosovo and Serbia engagements, where enemy air defenses remained inoperative for lengthy periods until priority targets were identified.<sup>31</sup>



**Figure 1. BQM-74 Drone<sup>32</sup>**

In the 1990s, with the development of the MQ-1 Predator, the UAV finally earned a permanent place in the US military's inventory.<sup>33</sup> Originally supported by the Army and Navy, the Predator was developed by the Defense Airborne Reconnaissance Office (DARO). In 1995, Air Force Chief of Staff General Ronald Fogleman directed the activation of the 11<sup>th</sup> Reconnaissance Squadron to operate these newly acquired UAVs, with the Air Force selected as the lead service for the US military<sup>34</sup>. As illustrated in Figure 2, the MQ-1 Predator was first used for reconnaissance missions. Within a few years, however, it was outfitted with Hellfire missiles to conduct attacks on enemy targets during Operation Enduring Freedom (OEF).<sup>35</sup>





**Figure 2. MQ-1 Predator.<sup>36</sup>**

Six years later, a larger, more powerful version of the UAV, the MQ-9 Reaper, emerged to conduct these roles in a more effective manner.<sup>37</sup> As is evident, the rise of the UAV—or Remotely Piloted Aircraft (RPA) as the US Air Force designates its current fleet of pilot-controlled UAVs—has matured extensively during the last twenty years and has focused almost exclusively on reconnaissance and attack roles, not deception. Unmanned systems do not risk aircrew and offer design efficiencies since they do not have to accommodate a human pilot or any required life-support equipment in the aircraft’s configuration or weight. These features offer intriguing possibilities to employ these systems to enhance operational deception during a conflict across the spectrum of adversaries from near-peer nation states to insurgencies, since design focus can be maximized for deception capabilities and, as required, can be destroyed during their deception use at a relatively affordable rate.

## Physical Deception

Physical deception entails deceiving the actual human senses. Of these, visual recognition is the predominant ability being used by individuals on a battlefield to “see and shoot” at their enemies and is, therefore, the primary human sense to be targeted for deception. In essence, if an adversary can be deceived visually, the likelihood of success can be improved significantly. As technology has advanced, so has the range that military engagements occur with technology aiding for “vision.” For example, the preferred range for combat aircraft to engage an adversary is at “beyond visual range,” or BVR. This preferred engagement range encompasses launching missiles and destroying enemy aircraft before they could ever be acquired visually by human eyes. Obviously, electronic means, such as radar, have become the advanced “eyes” in this case. On the other hand, there is still much combat that occurs at closer ranges and relies on human vision for execution. Urban ground combat between foot soldiers is a good example of where basic human vision is still essential to engage one’s adversary.

Humans rely on recognition of various elements to detect an object. Features such as vertical lines, curves, and diagonals form larger units and identify an object to an individual.<sup>38</sup> Physical deception, is simply causing an individual to believe an object, such as a UAV, is another object, such as a manned aircraft, in a tactical situation. Due to this, the UAV must simulate the actual manned aircraft but does not necessarily have to be a 1:1 replica in size or weight. For instance, when airborne, a one-third scale UAV might easily be mistaken for an actual-sized manned aircraft at 500 feet, the range which may be desired to deceive an adversary. The deception, in this case, is not necessary at five feet, at which it might be obvious the UAV were not the actual manned aircraft. However, when flying at a distance from an observer, the visual deception may be accurate from all directional aspects. The reader may have experienced

this phenomenon in the past when observing a small remote-controlled plane flying at a certain distance and mistaking the small craft for an actual airplane. However, when seeing the remote-controlled aircraft up close from five feet away, an individual will realize it was a tiny replica.

A secondary sense that can be used to aid in deception is sound. First, aural deception can help to complete a visual deception. For instance, in the above example, if an individual observed what he thought were an actual manned aircraft flying nearby but did not hear the expected accompanying sounds, the deception may not be realized. Therefore, in many cases, it may be important to ensure accurate and enhanced sounds to replicate the desired object. Also, there may be occasions when aural cues can be projected to deceive an adversary. One example of this may be the sound of gunfire emanating from an UAV to deceive an enemy on the location or existence of a hostile firefight. In certain situations, aural deception could be used to further confuse an enemy or cause them to react to a non-existent situation.

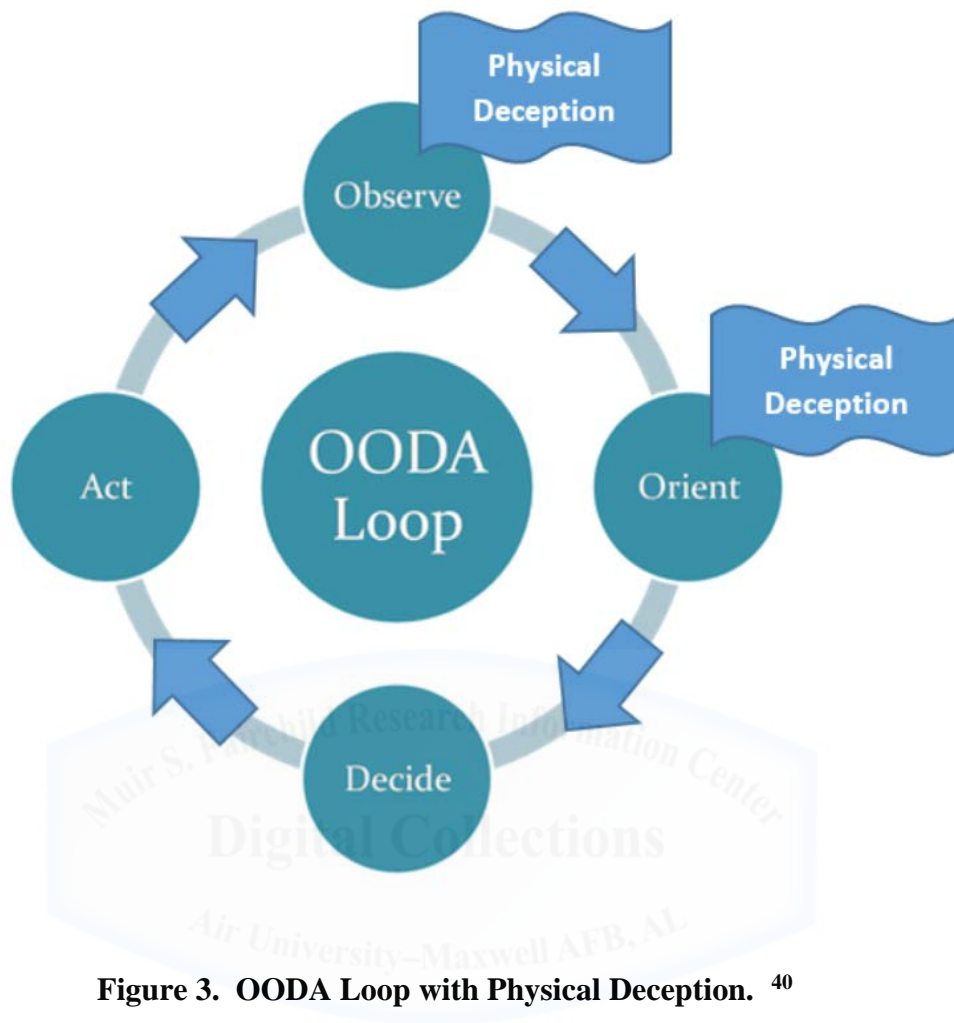
### **Getting Inside the Adversary's Observe, Orient, Decide, and Act (OODA) Loop**

Colonel John Boyd is known for being a modern theorist who focused on confusing an adversary's mind through control warfare. This method is called the OODA loop and is used to observe, orient, decide, and act expeditiously faster than the adversary. The OODA loop theory was integrated into the US defense policy in 1996. The OODA loop theory focuses on disorienting the adversary's mind by disturbing the process of receiving data and choosing courses of action. The first phase is "observe," which entails obtaining viable data about the present situation to determine the best course of action. The information collected needs to be accurate to best understand the current condition. "Orient" is the second phase, which allows a picture of the situation to be developed. The data used in this phase should be pertinent to the situation to ensure proper interpretation. This phase is a critical part of the OODA loop where

timing is of the essence. The next phase is “decide,” when a plan is formulated to address specific objectives. After a plan is developed, an individual must “act,” which is the fourth and final phase. In this stage, a decision needs to be conveyed and executed. The outcome of this action will be circled back to the beginning to perform the next OODA loop cycle.

The entire OODA loop cycle equates to the entire decision-making process, and the focal point is on paralysis through information domination. Col Boyd stipulates that speed and accuracy are the keys to obtaining a favorable edge in the OODA loop and suggests that success in conflict stems from assimilating inside an enemy’s OODA loop and remaining there.<sup>39</sup> OODA loop theory can apply to the operational as well as the strategic elevations of war.

The OODA loop, as illustrated in Figure 3, enables an understanding of the effectiveness of tactical deception. Successful deception, which disrupts an individual’s ability to either Observe or Orient will ultimately, ensure an impact on their decision and actions (Decide and Act). This will ensure higher success rates for combat missions by confusing adversaries and causing them to expend resources, delay their reactions, or react incorrectly. The use of UAVs to shape an adversary’s ability to Observe and Orient with physical deception can address vulnerabilities and limitations with US airpower’s capabilities that may not be overcome with other methods.



**Figure 3. OODA Loop with Physical Deception.** <sup>40</sup>

### **SECTION 3. PROBLEMS/KEY ISSUES**

The ability for an adversary to Observe and Orient presents a challenge for the US military when it cannot be overcome by advancing aircraft technologies or improvements in tactics. Two mission areas exist which demonstrate this aspect of air operations.

First, combat aircraft continue to be vulnerable to traditional air defense capabilities, such as small arms fire, when operating at low altitudes even against opponents without a modern air defense. This vulnerability exists when these aircraft can be directly observed by human vision and are within the range and capability of an adversary's weapons. Many missions, largely involving rotary-wing aircraft, must operate at this altitude regime to execute their roles.

Second, the successful execution of personnel recovery missions to recover downed aircrew will continue to be hindered in cases when the aircrew cannot be extracted quickly. Overall, the timeliness of the US military's response capability has not greatly matured during the last forty years.<sup>41</sup> The longer the time period until a recovery attempt, the less probability for a successful rescue since an adversary can orient to the situation and capture the aircrew before the individuals are extracted. Both of these areas may benefit from the use of TD UAVs.

#### **Observe – Low Altitude Aircraft**

Since Operation DESERT STORM, the US has matured its tactics, techniques and procedures (TTPs) for aircraft that have largely negated the ability of enemy air defenses to destroy or damage US fixed-wing combat aircraft. This has been accomplished by developing tactics and capabilities in the medium to high-altitude flight regime to prevent these air defenses from effectively being able to track and target the aircraft.<sup>42</sup> Medium and high flight altitudes comprise operations starting at 5000 feet above the ground and higher, with operations below

this level defined as low altitude flight operations.<sup>43</sup> In essence, the medium to high altitude flight regime is normally above the capabilities of non-missile ballistic defenses, such as small arms and cannon-type anti-aircraft defenses. While a focus on IADS destruction combined with electronic jamming, counter-radar capabilities, and, in some cases, stealth has negated the surface-to-air missile (SAM) threat extensively. Over the last 25 years, these characteristics and employment of US airpower have allowed minimal US aircraft losses to SAM capabilities of aerial engagements in various environments, including adversaries with robust IADS capabilities such as Saddam Hussein's Iraq.

However, these developments in the protection of combat aircraft during mission execution are due solely to the coupled maturation of technology and tactics at these higher altitudes, not the ability of the aircraft to sustain damage. While future missions in sophisticated air defense environments, such as an anti-access/aerial denial (A2/AD) scenarios, will pose challenges for combat aircraft at all altitudes, the issue remains that low-altitude flight operations will entail aircraft losses even against the least technologically sophisticated opponents.<sup>44</sup> When combat aircraft operate in the range of more traditional air defense threats, such as small arms, air defense cannons, man-portable infrared missiles, and RPGs, their survival rates are still significantly lower and mirror losses from previous conflicts such as in Vietnam. This is evident in the high damage and destruction rates of A-10s operating at lower altitudes to perform missions such as close air support (CAS) in both DESERT STORM and IRAQI FREEDOM.<sup>45</sup> In addition, 67 percent of North Atlantic Treaty Organization (NATO) fixed-wing aircraft damage and loss since 1982 occurred during low altitude combat missions, with the majority happening below 500 feet.<sup>46</sup> The obvious solution has been to conduct as many aerial missions at higher altitudes as possible. The advent of precision-guided munitions and advanced sensor capabilities

has allowed this to occur for many combat missions.<sup>47</sup> Likewise, in the future, successful operations in an A2/AD environment will require continued improvements in tactics and advanced technologies.<sup>48</sup>

Certain missions, however, will continue to be conducted within the range of the less sophisticated threats. Current technology has not allowed the human eye to be “jammed” – thus, an unsophisticated rifle shot from an individual still poses a threat. Missions that require an aircraft to operate in close proximity to the adversary, such as rotary-wing troop insertions, are in a direct threat line for attack. While these aircraft could transit to their objective at higher altitudes to decrease exposure to threats such as small arms weapons, their mission execution still requires them to operate, and in some cases land, within the range of these weapons. Unlike other missions that allow execution at safer altitudes, these aircraft are required to be in the range of these threats to successfully perform their combat role.

Due to this aspect of their mission, aircraft that are expected to operate in these lower altitude levels of flight are often designed with the ground threat in mind. The A-10, for example, has an armored “bathtub” to protect the pilot in the plane’s original design, and modern rotary-wing aircraft have numerous features to protect the crew and aircraft from small arms fire.<sup>49</sup> However, design considerations do not make these aircraft immune to attack damage. While extremely combat worthy, the long list of “downed” fixed and rotary-wing aircraft from small arms and cannon based air defenses since 1991 demonstrates the inability to design an aircraft that is truly immune to succumbing to these type of threats. In the end, if an aircraft can be observed and engaged successfully with weapons, losses will ensue. At the medium and high altitude regime, technology and tactics have improved survivability. The low altitude regime has



not benefited from this same improvement. Section 4 will discuss an alternative with TD UAVs to mitigate this issue.

### **Orient – Downed Aircrew Capture**

Personnel Recovery (PR) is one of the US Air Force's dedicated missions and can prevent adversaries from gaining a strategic advantage by leveraging a tactical event.<sup>50</sup> Today, with the prevalence of instant global communication and social media, adversaries can quickly shape public opinion and gain tremendous propaganda benefit with images of captured US personnel. PR can entail numerous methods of recovery, but this research focuses on the execution of dedicated Air Force or joint PR missions to recover downed aircrew, which has historically been hampered by several variables. A PR mission often entails the attempted recovery of isolated personnel in areas controlled by the adversary, such as aircrew ejecting from a damaged strike aircraft in enemy territory.

PR missions are often referred to as Combat Search and Rescue (CSAR) missions when performed by Air Force assets to recover downed aircrew or other isolated personnel.<sup>51</sup> The rotary wing aircraft often conducts the actual recovery of isolated personnel by hovering or landing near the isolated person to extract them from harm. Due to their unavoidable low altitude operations required during the recovery of personnel, these PR aircraft become vulnerable to damage and destruction by many common weapons low technology weapons especially since their arrival in enemy territory will not necessarily surprise the enemy if they are oriented to the location of the downed aircrew and observe the rescue forces in action. This factor is evident in one of the most robust periods of Air Force PR execution, the Vietnam Conflict, where 3,883 personnel were saved but one CSAR aircraft was lost during every 4.8 rescue missions.<sup>52</sup> Technology and equipment have matured over the decades since this conflict, but the same low

technology weapons remain major threats to PR aircrew and aircraft due to the inherent mission requirements.

Besides the vulnerabilities created by their low altitudes, another major variable in successful PR mission execution is time. The longer the time which elapses after a person is isolated, the less chance for a successful recovery and return to friendly control. In all major conflicts since 1968, about 45 percent of US downed aircrew have been capable of being recovered since they were not killed or immediately captured during their isolating event. However, after two hours, only about 25 percent could be recovered and after eight hours it was less than 20 percent.<sup>53</sup> Clearly, the longer period an isolated person remains unrecovered, a higher probability of being discovered or captured by enemy military forces or unfriendly local populace occurs as they are allowed to orient to the situation and search for the evading or hiding aircrew.

While new technologies such as modernized survival radios have improved reporting and locating capabilities over the last few decades, this technology has not greatly minimized the risk to isolated personnel in harm's way with respect to timely recovery. Individual camouflage capabilities and evasion techniques available to downed aircrew, as well as the speed of the recovery platforms to arrive at the isolated person's location, are similar to those of the Vietnam War.<sup>54</sup> Recently fielded vertical-lift capable aircraft, such as the V-22, are faster than traditional helicopters. However, they still pose the same vulnerabilities as their rotary-wing predecessors, and in some cases, offer fewer self-protection abilities in a PR role.<sup>55</sup>

As is evident, low altitude aircraft and downed aircrew capture still possess vulnerabilities and limitations that have not been fully addressed by technology or tactics. Due to the fact they are heavily shaped by an adversary's direct observation and orientation, often at an

individual level, and are not impacted by electronic jamming or radar stealth capabilities. TD UAVs may offer alternatives to assist with these issues.



## **SECTION 4. ALTERNATIVES**

As already mentioned, vulnerabilities exist for aircraft which must conduct their missions in the lower altitude flight arena. To successfully mitigate this vulnerability, the employment of deception UAVs can visually fool an adversary into believing they are observing a manned combat aircraft. This will shape their subsequent orientation, decisions, and actions to allow successful execution of desired manned aircraft missions.

### **TD UAV #1 – “Mission Wingmen” UAVs**

To successfully counter the low-altitude threat, adversaries must either be prevented from engaging or deceived into attacking the wrong target, and this can be accomplished by shaping their ability to Observe during the mission execution. As noted earlier, even aircraft that are specifically designed to withstand damage from weapons in this operating regime, such as small arms and RPGs, may still succumb to these weapons. Preventing an adversary from engaging aircraft flying at low altitudes, while indeed possible, mainly revolves around eliminating the adversary or his weapon capability before he can successfully engage an aircraft. Since the threat, in this case, may be a single individual equipped with an RPG, this is not always possible due to either not knowing the enemy’s precise location or not desired due to proximity or integration with civilian populations or other similar situations. The most effective alternative left is to deceive an adversary into engaging the wrong target, and this alternative can be effectively accomplished with a TD UAV.

As described previously, the US and other nations have successfully employed UAVs that mimicked the electronic signatures of a manned strike aircraft, causing radar operators to

engage these decoys. Using this same principle to deceive actual human vision, UAVs precisely mimic the visual pattern and flight characteristics of the intended manned platform in order to deceive an adversary into engaging the wrong target. These “Mission Wingmen,” or MW UAVs, can be used for numerous mission areas that require flight operations in the low altitude flight regime. They will be considered disposable in the sense that they will be intentionally employed to draw enemy fire when necessary, without concern for their survival. Control of these MW UAVs can be tethered to the manned aircraft, allowing control by an operator in the formation. Alternatively, they can operate automatically by maintaining a predetermined spacing, or programmed and launched independently of the manned platforms to execute a mission flyover or landing at a specific time and location. If they are not destroyed by enemy action during their mission, they can be returned to a friendly location for reuse on future missions.

Developed with the proper shapes and size replication to deceive observers to believe they are viewing an actual manned aircraft, these platforms can be developed to intentionally confuse and deceive an adversary. This confusion can be enhanced with two primary mission employment scenarios with MW UAVs. First, MW UAVs can perform traditional wingmen roles and fly with or ahead of the actual manned platforms during their mission execution. For instance, as described at the beginning of this paper, several MW UAVs could accompany rotary-wing aircraft during troop insertions or recovery events. Beyond just landing abreast with the manned platforms, they could be ordered to numerous nearby locations simultaneously. This would not only confuse but possibly overwhelm any nearby adversaries about which aircraft target to select while disguising the actual objective location for the manned mission. Coupled with visual and aural indicators of weapons being discharged from the MW UAVs, these platforms could greatly enhance the survival rate of helicopters during their most vulnerable

state, landing in hostile territory. Fixed-wing MW UAVs could perform similar roles during CAS missions, creating multiple targets for enemy troops and decreasing effective anti-air defenses.

Second, MW UAVs could be launched at random times and locations in enemy territories to breed confusion and complacency among enemy combatants. For example, numerous rotary-wing MW UAVs flying missions into hostile territory several times every night in different locations for months or years on end, without any actual objectives, will cause an enemy combatant to become confused on actual mission intentions. Even if it becomes known these are likely drones to the adversary, they will become complacent when an actual manned mission occurs, assuming the incoming aircraft are just “drones” again. Likewise, fixed-wing MW UAVs, replicating low-flying strike aircraft such as the A-10, could randomly fly over enemy controlled areas, causing similar confusion and tension to enemy combatants in a persistent manner.

The next type of TD UAV addresses the ability of an adversary to Orient to a specific situation, the search and capture of downed aircrew. This type of TD UAV will cause confusion in the adversary’s ability to orient towards the situation and may cause complacency in his behavior when utilized long term.

#### **TD UAV #2 – “Shootdown” UAVs**

The ability to shape an adversary’s Orient ability during a situation such as when a US aircrew is evading in enemy territory may enhance one of the most valuable assets during these scenarios: time. As discussed, the longer an aircrew is on the ground without recovery, the less probable it is that a successful rescue will occur. Due to the high propaganda value of capturing a US aircrew, adversaries have enacted high monetary rewards for their military or civilian

populace to successfully capture them.<sup>56</sup> When a US aircraft is shot down, an adversary will likely react with substantial resources and efforts to locate and capture the evading personnel. In these situations, the adversary has likely already observed the downing of an aircraft has occurred, especially when their air defense capabilities are the cause of the shutdown.

Next, an adversary will orient to the situation to coordinate resources and efforts for the capture of the downed aircrew. It is this aspect of the recovery scenario where TD UAVs can enhance the “fog of war” for an adversary as they attempt to orient and react to the search and capture event. Using tailored “Shutdown” UAVs, or SD UAVs, the US military can create deceptive, simulated destruction of an US fixed-wing strike aircraft at key moments and locations to confuse an adversary and cause the misuse of search resources and efforts for non-existent evading aircrew. For instance, for nighttime execution, SD UAVs could be developed to emulate a fiery streak across the night sky complete with a visual pilot ejection and subsequent aircraft explosion. The SD UAV would be destroyed in its act of fakery, but its mission execution—coupled with US radio traffic to emulate a US recovery attempt—would cause an adversary to react and start searching for the valuable aircrew, who apparently ejected. In addition, MW UAVs could be launched to simulate CSAR recovery forces searching for the downed aircrew, completing the illusion of an actual personnel recovery event.

There are two primary methods to employ SD UAVs. First, these SD UAVs could be activated soon after an actual shutdown of a US aircraft, causing an adversary to start search efforts in multiple locations, thereby spreading their search resources and lessening their abilities to discover an actual evading pilot. In this role, they would be kept on an alert-like status and activated soon after the actual event, in a chosen location geographically distinct from the real

one. By decreasing an adversary's capability to quickly find the aircrew due to decreased resources, the SD UAV would add time for friendly recovery forces to execute their mission.

However, their most effective use may be in activating SD UAVs at frequent, random intervals during an air campaign. At some point, an adversary will likely understand they are being fooled with false ejections, but the benefit of this template will be in causing complacency in an adversary's ability to orient to these scenarios. If an adversary becomes accustomed to these routine, "fake" shutdowns being executed, if a real shutdown occurs they may delay reaction to it if they believe it is yet another trick by US forces. At the individual level, a soldier may not be as enthusiastic and capable in a search if he has spent several hours in previous nights in a futile search in rough terrain and bad weather. When the search notification comes again a couple of nights later, he will likely not give it his best effort. The deception in this case is making an adversary believe all shutdowns are not real by conditioning, thereby masking an actual event and impacting the adversary's orientation and subsequent reaction, which will add valuable time to an actual recovery window since the adversary's command structure and forces will delay their reaction to the event.

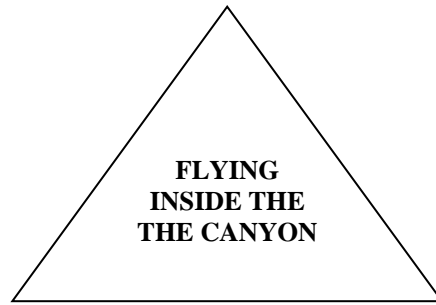


## SECTION 5: ANALYSIS

### Perception Deception

For Tactical Deception (TD) UAVs, the ability to deceive revolves around one simple key aspect: whether the adversary perceives the TD UAV to be an actual aircraft. As discussed earlier, the two senses that must be deceived by TD UAVs are vision and sound, requiring the TD UAV to appear, move, and sound as the actual manned aircraft it is replicating. An evaluation of the ability to deceive an adversary's perception in this respect is warranted. Unlike other forms of deception that may require complex relationships and situations to be built to deceive successfully, such as in counter-intelligence, TD UAVs only require the observer to believe they are seeing an actual aircraft in operation to shape their Observe and Orient abilities.

Perception heavily influences an individual's expectations, assumptions, and preconceptions.<sup>57</sup> Rather than just recording the environment around an individual, a person's senses, along with their mental processes, construct the reality an individual perceives.<sup>58</sup> With regard to deception, individuals are heavily biased towards perceiving what they are expecting to perceive.<sup>59</sup> Thus, observing an aircraft in an environment where an observer is expecting to see an aircraft should be successful, assuming the sensory aspects of the observation match those expected for an aircraft. A simple, classic example of the mental process can demonstrate the following visual passage regarding the words inside the following triangle:



**Figure 4. Visual Passage of Perception**

Unless the reader has seen similar puzzles before, the second “the” is normally not mentally processed since it is not expected to be present. The reader is expecting only a single “the” and constructs her perception accordingly.

For the two types of TD UAVs discussed as alternatives in the previous section, this perception bias will allow these platforms to successfully deceive an adversary. Both the MW UAVs and Shutdown (SD) UAVs will operate in environments where an adversary expects to see combat aircraft operating. For the MW UAV, the perception required is straight forward: the adversary observes and perceives an actual manned fixed or rotary-wing aircraft operating in its normal environment. The SD UAV is similar in that it also replicates an aircraft, but it also mimics the airborne destruction of an aircraft in flight along with an ejecting pilot. Although slightly more advanced in execution, in the end, the SD UAV deception on an adversary’s perception is identical. An adversary expects to observe combat aircraft operating in the area, and seeing one destroyed in flight is not necessarily an extraordinary experience.

Another beneficial aspect of an individual’s perception is it is resistant to change. Once an individual perceives an object and judges its essential characteristics, there is a bias to continue perceiving the object the same way even if new information becomes available.<sup>60</sup> This benefits the use of TD UAVs since once an adversary perceives that the MW or SD UAV is an actual aircraft, any minor discrepancies in the deception may be overlooked. Together, the

individual biases of perceiving what is expected as well as resisting changes to that perception bodes well for the successful operation of TD UAVs in combat operations.

### **Desired Effect on an Adversary**

Three areas can demonstrate the successful shaping of an adversary's Observe and Orient functions by deception. They consist of causing an adversary to expend resources, delay their reactions, or react incorrectly to tactical situations as depicted in Table 5.0. Using these three areas, an assessment on the implementation of TD UAVs as described in the previous section can be performed.

<b>Desired Effect on Adversary</b>
<b>Expended Resources</b>
<b>Delayed Reaction</b>
<b>Incorrect Reaction</b>

**Table 5.**

### **Scenario One: Special Operations Infiltration**

First, an assessment of the MW UAV will be accomplished. As discussed, these aircraft would perform numerous deception missions in the low altitude flight regime, creating confusion for enemy personnel by presenting multiple targets and aircraft movement across several locations, masking true mission objectives. A primary example of MW UAVs escorting manned helicopters during the infiltration of a Special Operations team can be used to assess the MW UAV concept. Similar to the historic example described at the beginning of this paper, this scenario will consist of 12 MW UAVs escorting three manned CH-47 assault helicopters into an objective area that has hidden enemy operatives equipped with small arms and RPGs. Many of

the MW UAVs will land separately in nearby areas, creating confusion regarding the real objective area, while others will accompany the manned helicopters into the actual landing objective. Table 5.1. contains an assessment of the MW UAV in this scenario.

<b>Desired Effect on Adversary</b>	<b>MW UAV</b>
<b>Expended Resources</b>	- Enemy gunners targeting MW UAVs - Movement of enemy troops towards MW UAVs
<b>Delayed Reaction</b>	- Focusing on MW UAVs in false landing areas
<b>Incorrect Reaction</b>	- Perceiving false landing areas as actual objectives

**Table 5.1. Desired Effect on Adversary/MW UAV**

The use of the MW UAVs in this scenario shape all three desired areas for successful deception. Other scenarios with the use of MW UAVs will yield similar results since they replicate actual manned aircraft to an adversary. Enemy gunners will expend resources against MW UAVs and react to their presence, causing delayed, lesser, or ignored reactions to actual missions being executed, since they are perceived as actual manned aircraft.

### **Scenario Two: Air Campaign**

Next, SD UAV can be assessed using the same criteria. In this case, a scenario will be used where a US-led coalition is performing an extended air campaign against ground troops in a contested area. The purpose of the campaign is to prevent further aggression against neighboring territories by the adversary's ground troops, but no US or coalition ground forces are being used. Although a majority of the adversary's IADS has been destroyed, mobile SAMs remain a constant threat to aircraft. As the US began the campaign, SD UAVs were activated at random intervals at a rate of about six times a month. In addition, the coalition lost one F-16 due to an enemy SAM during the second week of the campaign. During this actual loss, a SD UAV

activated 20 miles from the actual shutdown to confuse the enemy response. Coalition rescue forces successfully recovered the F-16 evading pilot. Due to their frequency, the adversary's commanders and troops realize that most SD UAVs are probably not actual shutdowns but are not able to discern the difference from an actual event, such as the one that occurred in the second week. After the fourth week of the campaign, enemy troops still react to SD UAV activations but are significantly slower in posturing for search efforts. It is currently the eighth week of the air campaign. Table 5.2. assesses the SD UAVs in this scenario.

<b>Desired Effect on Adversary</b>	<b>SD UAV</b>
<b>Expended Resources</b>	- Enemy troops searching for non-existent pilots
<b>Delayed Reaction</b>	- Perceiving actual shutdown as SD UAV
<b>Incorrect Reaction</b>	- Perceiving SD UAV as actual shutdown

**Table 5.2. Desired Effect on Adversary/SD UAV**

Other scenarios with SD UAVs should demonstrate similar positive deception results. In this scenario, the frequent use of the SD UAVs was purposely used to cause complacency and delayed reactions with the adversary's forces. However, more infrequent use of SD UAVs will still generate similar results, especially with the expenditure of resources and incorrect reactions criteria.

## SECTION 6: RECOMMENDATIONS

The military can more effectively employ UAVs in deception roles by developing tailored physical deception UAVs for the problem areas identified earlier: (1) aircraft that conduct missions within the range of lower technology weapons, such as rifles and unguided RPGs, and (2) mission scenarios that involve downed aircrew under threat of capture by the enemy. Physical deception UAVs, rather than the traditional focus of electronic deception UAVs, are needed to successfully deceive an adversary in these engagements.

This author recommends the development of numerous Mission Wingmen (MW) UAV types for US aircraft that conduct operations in the lower altitude spectrum. Table 6.0 highlights the various fixed and rotary wing aircraft types ideally suited for MW UAV companions.

	<b>Fixed Wing Aircraft</b>	<b>Rotary/Tilt Wing Aircraft</b>
<b>US Air Force</b>	A-10	HH-60, CV-22
<b>US Army</b>	NA	U/MH-60, C/MH-47, AH-64
<b>US Navy</b>	NA	SH-60
<b>US Marines</b>	AV-8B	UH-1, AH-1, CH-47, MV-22

**Table 6. Fixed Wing Aircraft/Rotary/Tilt Wing Aircraft**

In addition to the MW UAV, Shutdown (SD) UAVs should be developed to emulate certain fixed-wing strike aircraft. The emulated aircraft types should encompass combat aircraft equipped with aircrew ejection seats that an adversary would be expecting to be operating in the intended mission area. Table 6.1. depicts these airframes.

	<b>Fixed Wing Aircraft</b>
<b>US Air Force</b>	A-10, F-15E, F-16, F-35, B-1
<b>US Navy</b>	F-18
<b>US Marines</b>	AV-8B, F-18

**Table 6.1. Fixed Wing Aircraft**

The development of both MW and SD UAVs will decrease risk to aircrew and allow more effective mission execution for the US military and its allies. Coupled with the development of these UAVs, an examination of the proper organizational structure for TD UAV fielding and TD UAV tactics development should be initiated to ensure the most effective use of these platforms.

## SECTION 7: CONCLUSION

Deception has been described as the deliberate misrepresentation of reality to gain a competitive advantage.<sup>61</sup> General Dwight Eisenhower, as Chief of Staff of the Army in 1947, stated, "... no major operation should be undertaken without planning and executing appropriate deception measures."<sup>62</sup> As demonstrated in this research, the use of deception UAVs—specifically in physical deception to fool the “eyes and ears” of an adversary—can successfully misrepresent reality to an adversary and cause him to expend resources, delay reactions, or react incorrectly to tactical situations, thereby gaining an advantage in combat. While there has been successful historic use of deception with UAVs in the electronic realm, the yet largely unexplored use of physical deception in UAVs creates many benefits, especially against adversaries and mission scenarios that are not impacted by electronic deception or the development of advanced technologies such as stealth.

Despite the advancements in aircraft and tactics, low altitude flight in combat remains a risky endeavor even against the least technologically advanced adversaries, since the simplest of weapons can still destroy a multi-million-dollar aircraft if enemy combatants can see it and are capable of engaging it with their weapons. Likewise, time is of the essence when a downed aircrew is evading capture, and advancements in technology have not decreased the rescue response capabilities significantly over the last few decades. Both of these areas will benefit tremendously from the development and fielding of physical deception UAVs. Using UAVs in these physical deception roles will save lives and allow more effective mission execution, shaping overall US military operational success in future engagements.



## Notes

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