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THESIS: The current limitations in joint communications, the complexity of fire support coordination, the adaptive employment of fixed-wing aircraft, and current aircraft technological deficiencies all limited aviation's ability to fully meet the demands of this "transformed" type of warfare and require a revision of command and control and employment doctrine.

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JOINT AIR POWER, TRANSFORMATION, AND OPERATION IRAQI FREEDOM

by

Michael J. Gough
Major, USMC

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

Signature:_____

9 February 2004

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Abstract

JOINT AIR POWER, TRANSFORMATION, AND OPERATION IRAQI FREEDOM

An analysis of Operation Iraqi Freedom (OIF) shows that many aspects of the Department of Defense's initiative to transform the military have already been realized and have made the U.S. military a virtually unstoppable force on the symmetrical battlefield. Perhaps the most decisive transformation in the U.S. military to date has been in the role of aviation and its application across the joint battle space to achieve operational goals. The rapid and expansive operational maneuver demonstrated during OIF, coupled with technological advances in precision fires and command and control, made the joint use of fixed-wing aviation essential to the attainment of operational objectives.

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"It took him only a few minutes now to call the squadron leaders that he needed, assign them to certain ships or groups of ships, and give them their assignments. Then, as the battle progressed, he would skip from one leader's point of view to another's, making suggestions and, occasionally, giving orders as the need arose."–**Science fiction novel, 1977**.[1]

It is eerie sometimes how accurately science fiction predicts the future. Does the work of this genre actually harness Man's imaginative powers and influence the direction of future invention, or does it merely create coincidental similarities with future realities? What is certainly true, however, is that the current vision of the U.S. Department of Defense aims to transform the various elements of military power into an integrated, networked, and technology-based force worthy of any work of science fiction. In many respects, an analysis of Operation Iraqi Freedom (OIF) shows that much of this transformation has already taken place and has made the U.S. military a virtually unstoppable force on the symmetrical battlefield.

Perhaps the most decisive transformation in the U.S. military has been in the role of aviation[*] and its application across the joint battle space to achieve operational goals. The rapid and expansive operational maneuver demonstrated during OIF, coupled with technological advances in precision fires and command and control, made the joint use of fixed-wing aviation essential to the attainment of operational objectives. **However, the current limitations in joint communications, the complexity of fire support coordination, the adaptive employment of fixed-wing aircraft, and current aircraft technological deficiencies all limited aviation's ability to fully meet the demands of this**

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[*] For the purpose of this paper, air power/aviation and fixed-wing aviation will be synonymous. The role of rotary-wing (helicopter) aviation was significant during OIF, but is beyond the scope of this analysis. Also, this analysis will focus on air-delivered fires as opposed to the other roles of aviation.

"transformed" type of warfare and require a revision of command and control and employment doctrine.

Certainly, by all accounts, aviation employment was extremely successful in OIF. An analysis of the current joint role of air power, however, requires a short history of aviation's evolution for an adequate comparison to air power's current role as a decisive element of joint operations. The real operational debut of aviation was during World War II. The scope of the war as a global, multinational, and almost total war excludes it from any close comparison to today's regional and trans-national operations. The real lesson for this analysis, however, is that military aviation developed along service lines and amidst an extreme parochialism that would limit its effectiveness throughout the war and for most of the wars to come.

Another useful snapshot in the history of aviation was the Vietnam War. The cyclical air attacks against North Vietnam between 1965 and 1972 represent the largest aviation effort (in tonnage of ordnance) in U.S. history, as well as the nation's longest-running series of aviation operations.[2] Despite these enormous efforts and the heroics of U.S. aviators, the strategic restraints imposed by the President and Secretary of Defense, coupled with the limitations in targeting and the late introduction of precision munitions, made the overall operational effects of air delivered ordnance a failure. As one U.S. Air Force aviation historian declared in 1986, "when considered from the standpoint of air power theory and doctrine, the U.S. efforts in Indochina between 1965 and 1971 must be adjudged a failure verging on a fiasco."[3] Despite these harsh words, the real takeaways from the Vietnam War were that air efforts were unfocused on an operational scale, intelligence lacked any real capability to provide timely and accurate targeting, and aircraft systems limited pilots'

abilities to destroy targets. As in World War II, aviation continued to develop along service-centric lines, and the overall control of air assets was disjointed.

The U.S.-led Operation Desert Storm in 1991 has been touted as the coming-of-age of U.S. air power.[4] In fact, the term "Air Power" itself gained a commonplace popularity as a moniker for U.S.-style, technology-based, precision air dominance. The then Secretary of Defense, Richard Cheney, declared as his personal opinion that the decisive win against Iraq was "attributable in large measure to the extraordinary effectiveness of air power."[5] Far from the purist conceptions of Colonel John A Warden III's plan for a six-day "air campaign" to win the war without ground offensive, the contributions of aviation certainly had a decisively successful impact on the needed, yet short-lived land offensive.[6]

Although U.S. aviation dominated the Iraqi defenses in 1991, advances in technology still had not significantly increased precision capabilities across all services, and the actual results versus pilot reporting revealed inflated estimates of destruction and a continued weakness in bomb damage assessment.[7] The real improvement over previous operations, in terms of command and control, was the successful employment of the Joint Force Air Component Commander (JFACC) concept, which focused the aviation efforts across all services. Although this concept had its growing pains, the obvious strengths of centralized planning and command of air-delivered fires would lead to further improvement of JFACC doctrine.

Despite the successes of aviation in Desert Storm and the obvious advantages of jointly employed air, the military services continued their historical parochial maneuvering by debating each service's respective importance in the conflict. In fact, the Navy and Marine Corps attempted to downgrade the importance of the JFACC by changing the final

"C" to "Coordinator" vice "Commander" in the wording of the post-war report to Congress.[8] Despite this service rivalry, the JFACC concept continued to grow, and although currently dominated by the Air Force, arguably has become a force multiplier for joint combat operations.

> *"The equipment is the equipment that we have had for years. But the difference is how well integrated all the capabilities of the services are in this case.... Here, between the various capabilities the services bring to the table, we are in a mode of integrating them in a way, and applying effects on the battlefield, thinking about the effects we want to have and being able to mass at the time and place of our choosing with very good command and control, intelligence, and surveillance and reconnaissance."*—**General Richard Myers, Chairman of the Joint Chiefs of Staff—comments on OIF.[9]**

Throughout the 1990s, all services strived to fix many of the shortcomings identified in the lessons learned from Operation Desert Storm. The main focus in aviation was in precision targeting and munitions. Much as General Myers stated above, the aircraft involved in OIF were pretty much the same vintage as in Desert Storm, but the difference was in the scale of precision munitions employed, as well as in the ability of 100% of strike aircraft in theater to deliver these munitions as opposed to 15% in Desert Storm.[10] In fact, 68% of all air delivered ordnance was some type of precision-guided weapon as opposed to 7% in Desert Storm[11]. Significantly, the ratio of munitions delivered to specific target aim points was close to an amazing three to two.[12] This ratio was significantly higher in previous conflicts and required many more unguided bombs per target aim point for the same level of destruction as one bomb in OIF.

This growth in precision-guided munitions capability and employment, however, was only one small part of the story of the Coalition's success in OIF. As stated earlier, aviation was critical to the achievement of operational objectives, but the real story was one of integration and transformation. In his post-war testimony to Congress, Secretary of Defense

Rumsfeld stated, "The plan they developed for Operation Iraqi Freedom was even more innovative and transformational [than in Afghanistan]—employing an unprecedented combination of speed, precision, surprise and flexibility."[13] The plan as executed in OIF demonstrated two key components of the vision for a transformed and modern military—Dominant Maneuver and Precision Engagement[14]—and it would be the former that would give aviation its major difficulties and lessons learned for the war.

Dominant, expansive, rapid maneuver is not a new concept. From the very beginnings of armed conflict, the ability to outmaneuver the opponent always had distinct advantages, whether it was the American Indians outmaneuvering Custer, or the Germans' radical *Blitzkrieg* in World War II. What the U.S. forces[*] achieved in Iraq, however, was a level of maneuver dominance never seen before in recorded military history. While avoiding major Iraqi military formations and population centers, U.S. forces heading to Baghdad averaged 75 miles per day for the first four days of the war. Michael Eisenstadt of the Washington Institute noted that, "The U.S. forces racing to Baghdad have surpassed the achievements of the Germans in Russia (1941) and North Africa (1942), the Soviets in the Ukraine (1944) and Manchuria (1945), Israel in the Sinai (1967), and the United States in Iraq during Operation Desert Storm (1991)."[15]

This rapid maneuver not only created extreme dilemmas for the Iraqi military, it also created some difficulties for the U.S. forces as well. The much publicized "Operational Pause" on the sixth day of the war emphasized the strain put on logistical efforts, but did not highlight the difficulties (excluding weather) for U.S. aviation. The tenets of dominant

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[*] Although OIF was a Coalition military effort, the scope of this paper does not address the integration of coalition partners. The term "U.S. forces" in no way intends to downplay their significance in the war.

maneuver rely heavily upon the decisive use of aviation to shape the battlefield for continued ground maneuver, as well as to provide close-air-support (CAS) for ground forces in contact with the enemy. When the maneuver is as rapid and expansive as in OIF, the planning for air delivered fires, their coordination and deconfliction, and the ability to rapidly prosecute targets in concert with maneuver are critical to success.

Needless to say, this is a tall order, especially considering the previously described history of aviation and its tendency to have friction along joint lines. The JFACC and U.S. air forces, however, rose to the occasion and adapted as necessary to accomplish the mission. A weakness to any adaptation, unfortunately, is that it is a deviation from doctrine and can cause confusion at the subordinate level if careful communication of intent and effective control measures are not put into place to ensure common understanding.

In the rapid maneuver to Baghdad, both major ground forces—the Army's V Corps and the Marine Corps' I Marine Expeditionary Force (MEF)—bypassed numerous population centers and military formations. In order to preserve combat power for the attack of Baghdad, both the V Corps and I MEF relied upon joint aviation assets to provide security to their lines-of-communications (LOCs), instead of detaching piecemeal ground units for that mission. In order for the JFACC to accomplish his mission, he needed to integrate all aviation assets to a level never seen before in Joint Warfare. Because of its lack of organic heavy armor, the Marine Corps normally jealously guards its air assets for CAS and shaping operations. This was not the case for OIF. Lieutenant General Earl B. Hailston, Commander, U.S. Marine Forces Central Command commented, "The key to success of Operation Iraqi Freedom was unquestionably the outstanding cooperation between all of the services and coalition partners…. The rapid advance of Marine forces to Baghdad would

never have been possible without the tremendous service support provided to us by the Army. In turn, we've supplied the Army with Marine close air support and airlift. Marine Air assets were combined under the air component commander, General Buzz Moseley, to provide deep-air attack missions, hundreds of close-air-support missions, and airlift to support elements of all coalition forces."[16] This "Joint" approach to operational ground maneuver, however, was not without its problems.

The Army used an Air Support Operations Center (ASOC) for control of air assets and the Marine Corps used a similar organization, the Direct Air Support Center (DASC). Theoretically, both organizations perform the same function. They both work through their respective, service-specific control agency to coordinate with the Combined Air Operations Center (CAOC) on one end, and with maneuver unit fire support coordination centers on the other, to provide timely targeting data as well as to control the flow of aircraft to the supported unit's forward air controller (FAC). Prior to OIF, in fact, the services had a meeting of CAS experts to make sure that Marine FACs, Air Force terminal attack controllers (TAC), and Air Force Special Operations Command combat controllers were all using the same terminology to preclude confusion. [17] Just re-read the preceding sentence to appreciate that terminology still remains a complicating issue. Fortunately, once most pilots reached the appropriately named terminal controller, they were able to use their respective precision delivery systems to prosecute the target with reliable effects.

The real difficulty, however, was in communications in general. Many pilots reported that the boundary line between V Corps and I MEF was more of a communication brick wall than a line on a map. Since the ASOC and DASC were not similarly configured in terms of manpower and in terms of radio equipment, there really were two barriers. The first

barrier was in the training of the controllers. The Marine Corps DASC and Army ASOC seldom cross-train with tactical air forces, so that in this joint operation, there was occasional confusion in terminology. Commenting upon this confusion, Colonel William Rew, the CENTAF director of operations for OIF stated, "Another area for improvement is to clarify the different interpretations of close-air-support so all players have the same base line."[18] The second barrier was in the actual communications equipment of the controllers. As Major Greg Defore, chief of close air support at the CAOC during OIF stated in a post-war interview, "While dissimilar communications sometimes served as a limiting factor, [we were] able to achieve interoperability."[19] Later in the interview Defore stated, "Skillful aviators and controllers often can work around equipment interoperability problems."[20] Yet most aviators with combat experience in today's Joint world would likely admit that the most stressful times on many of their missions did not come from hostile fire, but instead came from anxiety about establishing communications with the appropriate controlling agency.

These difficulties in communication along a joint seam are not unique to OIF and have been included in lessons learned from the first use of aviation to today's modern battlefield. Admiral Arthur K. Cebrowski, the Pentagon's director of the Office for Force Transformation is responsible to Secretary of Defense Rumsfeld for the continued integration and modernization of today's and tomorrow's joint forces. The vision from his office is "Network-Centric" warfare. Commenting on this vision, Admiral Cebrowski stated, "We're going to see a new air land dynamic. It's as if we discovered a new sweet spot…through tighter integration of those. The process will be driven by better sensors, good networked intelligence, high-speed decision-making and the ability to exploit the noncontiguous battlefield."[21] The key for this new process to work, obviously, is the smooth exchange of

intelligible communications, whether it is data, imagery, or voice. In a sense, it is will be the "connectedness" of the operational to the tactical and vice-versa that will be the key to network-centric warfare.

In the case of OIF, this connectedness existed for some units, while others had a relatively degraded integration to the operational picture. Admiral Cebrowski admitted that there was a pronounced weakness in connectivity at the tactical level. "What will be interesting," he commented, "are the differences in performance and tactics by people who were well connected at the tactical level, versus those who were not."[22] One particularly important seam in connectivity was between the CAOC and sea-based aviation. Although force levels changed throughout the war, of the approximately 650 fighter/attack aircraft in theater, just under half were sea-based. The Navy's and the Marine Corps' ability to project air power from the sea was critical for this war, since limited basing options restricted the amount of tactical air assets that could be based ashore.

Given such a large percentage of sea-based aircraft and the long history of the importance of naval aviation, it would seem logical that communication to sea-based units would leverage the most advanced technology to ensure the situational awareness of these units guaranteed success. The Navy did, in fact, send a large liaison element representing carrier-based air to the CAOC, and as well, ensured that a naval aviator, Vice Admiral David C. Nichols Jr., was the Deputy JFACC during major combat operations. These efforts grew out of the lessons from Operation Enduring Freedom in Afghanistan and arguably improved coordination between the needs of the ground forces and the air units supporting them.

Despite all these improvements, however, a significant and important degradation of situational awareness existed at the tactical level of sea-based aviation units. There are

numerous examples of sea-based pilots launching from carriers with only a vague idea of the ground scheme of maneuver and of what to expect upon check-in with the supported unit.[23] General Moseley, the JFACC himself, admitted, "...there are many ways to streamline and improve the communications, the prioritization and orchestration of weapons to address the CINC's priorities as well as the land and air component commander's efforts."[24] These deficiencies were exacerbated for sea-based units by bandwidth limitations and Navy command and control architecture.

Air power has an inherent flexibility of employment due to its freedom of maneuver in an air superiority situation. Despite the connectivity issues discussed above, the JFACC very successfully employed his air assets to support the rapid maneuver of ground forces. As stated, this involved complete, 24 hour per day CAS coverage of a very expansive battlefield. In fact, of all the fighter/attack sorties flown in OIF, 79% were dedicated to Kill-box Interdiction and CAS,[25] an apportionment that required an integrated joint effort from all services. This concept of the "Kill-box" was not new to OIF; however, its use and employment methods to cover the requirements of such a large joint battlefield were new, and although effective, created some difficulties in both the air and on land.

The Kill-box is a technique of dividing areas of operation into smaller chunks to facilitate situational awareness and to increase flexibility in assigning aircraft to specific target areas. Each Kill box can be subdivided to define more specifically the area to be targeted. The problem with Kill-boxes, however, is that they are non-doctrinal.[26] Doctrinally, an area of operations will be overlaid with Fire Support Coordination Measures (FSCM) to "facilitate the timely and safe use of fire support."[27] These control measures ensure proper deconfliction of fires and endeavor to prevent fratricide. Normally, Kill-boxes

are used to define an area in which a strike aircraft can look for targets on the ground

commander's priority list and engage those targets without terminal control, because they

should be active only when forward of the Fire Support Coordination Line (FSCL) and

should be clear of friendly troops.

As previously stated for OIF, however, the friendly ground forces—both conventional

and special operations forces—were spread across an expansive area and had bypassed many

Iraqi military formations without detaching large ground forces to secure LOCs. The plan, as

stated, was to use air power across the depth and breadth of the joint operations area to

facilitate timely and lethal responses to enemy activity. The FSCL, therefore, moved ahead

of the rapidly advancing maneuver forces, leaving a large area behind them that doctrinally

required coordination with a trained ground or air terminal controller for air-delivered fires.

This controller theoretically would know all friendly locations, as well as understand all

direct and indirect fire support schemes.

The OIF version of the joint publication for CAS, Joint Publication 3-09.3, was dated

1 December 1995, indicating that the published CAS procedures were outdated and neither

included the lessons from Kosovo and Afghanistan, nor did they maximize aviation's new

precision capabilities. Because the area behind the FSCL was so vast, the limited number

and availability of trained terminal controllers forced another adaptation to doctrine. This

adaptation to CAS doctrine came in the form of the use of Kill-boxes as FSCMs and the use

of new, less restrictive types of terminal control of aircraft. These measures took advantage

of the increase in precision targeting and delivery since Desert Storm and allowed aircrews to

target key enemy formations throughout the joint operations area. As with all adaptations to

doctrine, these changes needed to be thoroughly planned, briefed, and controlled to ensure proper understanding and seamless execution.

The reality of these changes, however, was that the terminology used, as well as the FSCM scheme employed, ended up confusing many aviators as well as ground maneuver commanders. In fact, these changes were literally sent to supporting units as PowerPoint briefs and as text descriptions in the Special Instructions to the Air Tasking Order prior to the commencement of the war.[28] As previously stated, these changes were necessary to allow aviation assets to cover effectively the LOCs as well as to provide a quick reaction to moving Iraqi forces.

The Kill-box quickly became the airspace control and fire support coordination measure *du jour*. As the need would arise, aircraft would be sent to certain Kill-boxes short of the FSCL and would be cleared to engage targets by the ASOC or the DASC. The term "Open" and "Closed" were use to imply permission, or lack thereof, to engage targets within the Kill-box. As the maneuver units closed in on Baghdad, most pilots were more interested in which Kill-boxes were "Open" and less concerned with the positioning of the FSCL. In essence, "Open" Kill-boxes replaced being forward of the FSCL in terms of clearance to fire without terminal control. The danger in this case was that although great improvements in friendly force tracking and target identification had been made since Desert Storm, these methods remained an imperfect system and the risk of fratricide certainly existed.

As Admiral Cebrowski said of OIF, "the comfort level for all indirect fires is going up."[29] Yet the "pucker factor" of most traditionally trained CAS pilots was certainly higher than in previous conflicts, not for enemy actions, but for fear of dropping a weapon on friendly forces. Computer-based systems such as Command and Control PC use GPS reports

received from friendly forces to display their positions on a computer screen in a scalable and interactive format. Although this tremendous advance in technology gave pilots information on friendly force locations prior to launch, the latency inherent in current tracking systems, rapid ground force maneuver across the entire area of operations, and the inability of pilots to update this information during lengthy missions made these systems imperfect. Moreover, in order to support the dynamic requirements of ground maneuver, most missions deviated from the Air Tasking Order's assigned target area and made preflight focus upon a specific mission area impossible. Often, several hours into a mission, numerous Kill-boxes had opened and closed several times, or might even have been only partially open.

Due to this continuous change, pilots were forced to rely upon the situational awareness of the ASOC or the DASC to ensure Kill-boxes were clear of friendly forces. Add to this already complex situation the factors of weather, day/night operations, still imperfect combat identification systems, and a healthy dose of fog and friction, and the need for caution is obvious. The following statement by General Tommy R. Franks, Commander U.S. Central Command, sums up the great successes of the flexible use of air power, but also highlights the potential for confusion: "At certain points, special operations forces and ground units support air forces by pushing enemy formations into positions to be destroyed by air power. And in yet other cases, our naval elements support air, support ground operations or support Special Operations forces by providing aircraft, cruise missiles or by conducting maritime operations or mine-clearing operations."[30]

The aforementioned non-doctrinal use of Kill-boxes as FSCMs at times also created confusion for the ground commander. The Marine Corps prides itself upon the integration of its air-ground team, but several maneuver units were hampered by the Kill-box concept.

Although the opening and closing of Kill-boxes was coordinated by the Marine Corps' Tactical Air Command Center, the imposed restrictions to ground maneuver in open Kill-boxes short of the FSCL baffled some commanders. In fact, a Commanding Officer of a Marine Light Armored Reconnaissance Battalion stated that he was totally surprised by the concept and was denied the use of key terrain for maneuver due to an overlapping open Kill-box.[31] Although this commander's view of the battlefield was at the tactical level, there was doubt about the quality and reliability of Kill-box management both on the ground and in the air, leading to some erosion of confidence in air-ground cooperation.

The concept of dominant maneuver in the Joint Chiefs of Staff document *Joint Vision 2020* leverages the advantages of technology to keep the enemy force at a continuous disadvantage.[32] Theoretically, the enemy will be unable to keep pace with the U.S. decision cycle and constantly will be reacting to our actions. In order for the JFACC to keep pace with the ground commander's maneuver, his airspace coordination plan needs to be flexible, and his tasking of units for interdiction and CAS missions must be timely and accurate. In OIF, an unintended consequence of the JFACC's increased capability to "flex" was the numerous daily changes to the Air Tasking Order and to airspace control measures. Enhancements in computer-controlled battle space management allowed the JFACC to track an average of 1800 airspace control measures, of which at least 1200 were implemented daily.[33] At the "pointy" end of the war, tactical units needed to manage these changes, many of which occurred in flight. The real outcome of this quantity of change was that it was often unmanageable at the tactical level, and many aviators simply put their trust in God, their training, and that someone else at the other end was managing the seeming chaos.

As alluded to earlier, mainly the same types of aircraft were employed in OIF as in Desert Storm. The major difference was that while stealth was the surprise weapon in Desert Storm, the level of precision air-delivered destruction was the surprise to the Iraqis in OIF. The focus on precision between the two wars had its obvious payoff. Instead of large numbers of unguided munitions required for a given level of destruction, the U.S. forces relied upon precision to kill critical targets with an unprecedented level of efficiency and confidence. One Iraqi commander lamented the decision to move major units south to defend Baghdad by stating, "While they were moving, the Republican Guard were a target for American fighter planes and they lost a lot of men."[34] In fact, the successful combination of responsive air power with precision engagement allowed U.S. joint air forces to devastate Republican Guard units and eliminate them as threats to operational maneuver. The true outcome of the ability to identify and neutralize emergent threats throughout the battle space was that Fixed-wing Close-Air-Support rarely was "Close." A good example of this was when the Iraqi Baghdad Armored Division reinforced Al Kut in an attempt to halt I MEF forces at the critical river crossing of the Tigris River. Although these Iraqi Republican Guard forces used camouflage and deception in an attempt to hide from U.S. air power, U.S. intelligence and surveillance assets located their forces near Al Kut and assigned their destruction to Marine Corps aviation. In successive waves from the amphibious carrier USS *Bonhomme-Richard*, Marine Corps Harriers targeted and destroyed the enemy tanks, support vehicles, and even an SA-6 mobile missile launcher. Although I MEF's subsequent maneuver across the Tigris still required some fighting with the enemy, a key threat had been eliminated, thereby reducing the need for "Close" CAS.[35]

Despite these demonstrated strengths of joint air power, incompatibilities between communication equipment and data-link capabilities of the various service aircraft impeded a more thorough development of situational awareness for the aircrew and created some friction. Communications has already been discussed, but data-link capabilities need further analysis. All services are now beginning to develop data-link capabilities that enable a single aircraft to share the operating picture with other off-board sensors, such as with other aircraft and ground/sea-based radar stations. The problem with currently fielded systems, however, is they lack joint interoperability because the data-link technology developed by the Navy does not communicate with that developed by the Air Force and vice versa.[36] Another key problem is that these various systems do not integrate with the ground order of battle or with FSCMs and airspace control measures. Fortunately, many aircraft now have GPS-integrated moving map displays as an aid to navigation and situational awareness, but they lack the integration of key coordinating information into these displays. As discussed earlier, the rapid ground maneuver of OIF required many broad adaptations to air power employment, some of which greatly increased pilot workload. The lack of real time integration of these dynamic control and coordination measures into cockpit moving map displays degraded pilot situational awareness and could be likened to having a moving map in a car without projecting the key roads and highways.

CONCLUSION AND RECOMMENDATIONS

Operation Iraqi Freedom pitted a transforming, technology-intense U.S. force versus a less capable, yet significantly larger enemy. The operation relied upon dominant and rapid maneuver across a large operating area to keep the enemy off balance and to leverage U.S. air power to strike key strategic targets, as well as to provide security for the smaller U.S

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force across the breadth of Iraq. Many advances in precision and targeting allowed U.S. air power to economize the use of air assets and ordnance and to mass fires at the decisive point. The operation saw the employment of the breadth of U.S. air power, from upgraded Vietnam era B-52s to 21st Century Global Hawk unmanned aerial vehicles.

Although integration of air assets under the JFACC was highly effective, some joint friction and seams still existed at the operational and tactical levels, albeit at a significantly reduced level than in the previous wars discussed. Nevertheless, the network-centric vision of the Department of Defense is becoming a reality and was partly realized by U.S. forces in Iraq in 2003. A current shortfall, however, is that dominant maneuver and rapid, computer-aided changes in command and control capabilities are outpacing the abilities of pilots and aircraft systems to smoothly manage the resultant battle space dynamics. Before the vision of 2020 becomes a reality, therefore, joint doctrine and joint training need to be continually revised and exercised as the force transforms and should reflect the actual readiness of U.S. air power. The following are recommendations based upon the foregoing analysis:

- Continue developing the integration of communication systems and doctrine across the joint force and ensure that communication barriers along joint boundaries are eliminated.

- Revise Joint Close-Air-Support doctrine to either validate Operation Iraqi Freedom's use of Kill-boxes as Fire Support Coordination Measures, or to redefine Kill-boxes to eliminate any doubt as to their doctrinal employment. Although Joint Publication 3-09.3, Joint Tactics, Techniques, and Procedures for Close Air Support, has been revised since the war, it still does not reference Kill-box employment.[37]

- Combatant Commanders should recommend that an integrated air and ground picture for legacy and future aircraft be funded through the Joint Requirements Oversight Council.

- Until this integrated picture is fielded for all aircraft, joint doctrine for airspace control, fire support coordination, and the employment of joint air assets should address the limitations of current aircraft technology to keep pace with the rapid and numerous command and control changes required for "Dominant Maneuver."

In his book *The Masks of War*, Carl H. Builder asserts: "the American military services are driven by glacial engines for stability."[38] This statement is an indictment of the ability of the services to change and of their ability to cooperate for a common, "joint" goal. As discussed in the above analysis, even on the modern battlefield, there continues to be friction along joint lines. If the vision of transformed warfare is to be realized, therefore, a seamless integration of joint air, land, and space assets must be the product of continuous, yet coordinated change. The implementation of the above recommendations would increase joint operational effectiveness during dominant maneuver warfare, improve the confidence between joint air and ground forces in today's dynamic battle space, and significantly reduce the risk of fratricide incidents.

NOTES

[1] Orson Scott Card, *Ender's Game*. (New York: Tor Books 1977), 192-193.

[2] Benjamin S. Lambeth, *The Transformation of American Air Power*. (Ithica, New York: Cornell University Press 2000), 12.

[3] Ibid.

[4] Ibid., 4.

[5] Ibid., 5.

[6] Ibid., 105-106.

[7] Ibid., 104.

[8] Ibid., 5.

[9] Anthony H. Cordesman, *The Iraq War. Strategy, Tactics, and Military Lessons,* (Westport, CT: Praeger Publishers 2003), 57.

[10] Cordesman, 218.

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[13] Donald Rumsfeld, "Statement," U.S. Congress, Senate, Senate Armed Services Committee, *Lessons Learned During Operations in Afghanistan and Iraq*, 9 July 2003.

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    [20] Ibid.

    [21] David A Fulghum, "Fast forward: The Pentagon's Force-transformation Director Takes an Early Swipe at What Worked and Didn't in Iraq," *Aviation Week and Space Technology*, 158 (28 April 2003): 34.

    [22] Ibid.

    [23]This statement comes from the author's personal experience as a Marine Corps Harrier Squadron Operations Officer for OIF and from numerous interviews with pilots from all services.

    [24] Jason L. Haag, "OIF veterans discuss lessons," *Air Force Print News Today*, 31 July 2003, <http://www.au.af.mil/awc/awcgate/af/20030731news-oif.htm/> [7 January 2003].

    [25] Cordesman, 27.

    [26] Joint Chiefs of Staff, *Joint Tactics, Techniques, and Procedures for Close Air Suport (CAS)*, Joint Pub 3-09.3 (Washington, DC: 3 September 2003). The previous version of this publication dated 1 December 1995 was actually in effect during the war, but makes no mention of Kill-boxes. There is no mention of Kill-boxes in the new CAS publication and a search for the term "Kill-box" in other Joint Publications on Command and Control and Fire Support Coordination yielded no results.

    [27] Ibid., III-21.

    [28] Personal experience of the author.

    [29] Fulghum, 34.

    [30] "Briefing with CENTCOM Commander General Tommy Franks," *Global Security.org*, 22 March 2003, <http//www.globalsecurity.org/wmd/library/news/iraq/2003/iraq-030322-centcom03.htm/> [18 January 2004].

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[32] Joint Chiefs of Staff, *Joint Vision 2020*, (Washington, DC: 2000), 20-21.

[33] Cordesman. 184.

[34] Scott Peterson and Peter Ford, "From Iraqi officers, three tales of shock and defeat," *Christian Science Monitor*, (18 April 2003): 1.

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