

13th ICCRTS

“C2 for Complex Endeavors”

Suggested Topics:

Topic 1: C2 Concepts, Theory, and Policy

Topic 5: Organizational Issues

Topic 8: C2 Architectures

Transitioning from “Command & Control” To “Command & Trust”

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13th International Command & Control Research and Technology Symposium**Transitioning from “Command & Control”
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“Command & Trust”**

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Abstract

"The art of command is not that of thinking and deciding for one's subordinates as though one stood in their shoes." - Ferdinand Foch, Marshal of France

During the Vietnam War, the Department of Defense Command & Control (C2) processes were confronted by an intensely agile adversary and a growing uncertainty concerning the impact of guerilla warfare on our forces. Such uncertainty resulted in a C2 mindset that pushed the C2 processes into a corner – resulting in the Commander-in-Chief placing the majority of all warfighting resources under his direct control. Forty years later, our current C2 mindset about the Iraq War has changed very little – squeeze the maximum out of every resource and person. Recent implementation of C2 includes the ability to dictate all activities; it seeks to preserve stability, predictability and centralized control. It worked well in World War II against fairly predictable strategies of armored and personnel movements. Today, multi-domain effects space is making our traditional C2 processes less effective. We need a different mindset, a different set of relationships, to reduce the complexity of the endeavors. In previous CCRTS papers the authors suggested alternative forms of C2 to include “Command & Collaborate” and “Command & Self-Control.” In this paper the authors present a revised C2 process they call “Command & Trust” that could result in evolving C2 into the 21st century if properly architected.

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“You owe it to your men to require standards which are for their benefit even though they may not be popular at the moment.”

– GEN Bruce Clarke, Military Review, July 1980

1.0 Introduction

In the early days of the republic, subordinates were given a good deal more freedom by their commanding officers than they are today – frequently by necessity. The commander issued general, high-level orders (often handwritten on a single sheet of paper) and trusted that their subordinates would use their training, experience and overall best judgment to carry out those orders. Conversely, the commanders in the field trusted that the orders coming from Headquarters were similarly based on sound intelligence and on their superior’s training and experience in warfighting tactics and techniques.

During the U.S. Revolutionary War, John Paul Jones sailed off to the North Sea near Ireland and Scotland with these orders: ‘Assist the American cause however possible.’ He and his officers and crew sailed independently and were not contacted by a superior for months, yet Jones succeeded in the execution of his orders.

Following Prussia's disastrous defeats by Napoleon in 1806, Prussia’s “Lessons Learned” acknowledged the need for fresh thinking about the nature of war: “Long-winded orders on dispositions must not be given before a battle. [The commander] looks at as much of the ground as he can, . . . gives his divisional commanders the general idea in a few words, and shows them the general layout of the ground on which the army is to form up. The manner of deployment is left to them; fastest is best. The commander cannot be everywhere. He must always keep the picture as a whole in his mind's eye and shape it, mainly by sound handling of the reserves.” [Simpkin, 1985]

During the U.S. Civil War, training to fight independently was of the utmost necessity because the communications that existed at the time to implement Command & Control required that the overall Commander and his lieutenants in the field be within visual range (e.g., flags, fires) or within hearing distance (e.g., bugles, drums). Once the lieutenant in the field was over the next hill, or had sailed over the horizon, they had to become much more independent. Messengers carrying new orders were slow at best or at worst, never arrived. Except for the introduction of the airplane, hardly anything changed when World War I began some 75 years later.

In the early days of World War I, generals tried to direct tactics from headquarters many miles from the front, with messages being carried back and forth by couriers on motorcycles. It was soon realized that more immediate methods of communication were needed. Radio sets of the period were too heavy to carry into battle, and phone lines laid were quickly broken. Runners (including the use of dogs), flashing lights, and mirrors were used. The dogs were used only rarely, as troops tended to adopt them as pets and men would volunteer to go as runners in the dog's place! There were also aircraft (called “contact patrols”) that would carry messages between headquarters and forward positions, sometimes dropping their messages without landing

[Wiki, 2007]. Even in the Summer of 2002 these techniques continued to be effective against much more technologically advanced forces [Gladwell, 2005][Curts, 2006].

Even during World War Two, as faster and better communications began playing a bigger role in Command & Control, a succinct high-level mission order was issued to Dwight Eisenhower from the Combined Chiefs of Staff: “You will enter the continent of Europe, and, in conjunction with the other United Nations, undertake operations aimed at the heart of Germany and the destruction of her armed forces.” [Pogue, 1954]

With the proliferation of such communication links as e-mail, cell phones, the internet, satellites and other ever-expanding, nearly instantaneous and more reliable communications channels, Commanders now have the ability to talk to their subordinates in real-time, anywhere in the world. This ability to virtually place a Headquarters Commander at the “pointy end of the spear” has also allowed some of the same Commanders (including civilian authorities) to pick up a nasty habit of exploiting those links and thus applying more control over their field commanders. Whatever happened to the concept that the commander in the field had the best perspective and could be trusted to make the best judgment in tactical situations? Or, as General Colin Powell put it: “The people in the field are closest to the problem, closest to the situation, therefore, that is where real wisdom is.” “The commander in the field is always right and the rear echelon is wrong, unless proven otherwise.” [Harari, 2005]

Skipping the command, control and communication failures of the past, including the Israeli attack on the USS *Liberty* in 1967, Vietnam (including the evacuation of Saigon), the *Pueblo* Incident in 1968, the Iranian hostage rescue attempt in 1980, Grenada in 1983, the Libya Raid in 1986, the shoot-down of Iran Air Flight 655 by the USS *Vincennes* in 1988, and Operation Desert Storm in 1991, we can jump straight to today’s Iraq War and the meltdown of the more recent applications in Command & Control. One example is the Abu Ghraib prison scandal.

James Schlesinger, former Secretary of Defense, Energy Secretary and Director of the CIA, chaired the commission looking into the abuses at the Abu Ghraib Prison. Despite being hand-picked by then Secretary of Defense Donald Rumsfeld, Mr. Rumsfeld was in for a surprise. In the Commission’s final report on abuses by U.S. interrogators stemming from the Abu Ghraib Prison scandal, the “Schlesinger panel” went with the view that failures of command and control at the Pentagon helped create the climate in which the abuses occurred. Specifically, the finger pointed directly to the Secretary of Defense (SECDEF) for failing to provide adequate numbers of properly trained troops for detaining and interrogating captives in Afghanistan and Iraq. Rumsfeld’s office was rebuked for not setting clear interrogation rules and for neglecting to see that guidelines were followed.

“Some on the commission also believe that Rumsfeld and senior officials failed early on to set up clear, baseline rules for interrogations—an ethical “stop” sign, in a sense. This opened the way to abuse in an atmosphere in which President George W. Bush and senior officials were demanding that interrogators obtain better intelligence and were openly questioning the Geneva Conventions. According to testimony heard by the Schlesinger commission, the lack of direction from the top created confusion at Abu Ghraib and other prisons. Documents [reviewed by the

Schlesinger commission] indicate that interrogation officials often undercut or ignored Army Field Manual 34-52, the standard doctrine setting interrogation guidelines in conformance with Geneva.” [Hirsh, 2006]

There are, of course, conflicting theories as to how and why command, control and communications failures occur. But in Iraq, “... the conflicting theories on [why we are not winning] reflect growing divisions within the military along generational lines, pitting young officers, exhausted by multiple Iraqi tours and eager for change, against more conservative generals.” [Jaffe, 2007] One theory concerns itself with the tight reins being placed on the Control portion of “Command & Control” by senior Commanders. With a loss of control in the field, trust in being able to successfully perform the mission quickly dwindles.

Perhaps it is time to regain some of that trust. Many believe that the modern term “Command and Control” came about with the issuance of DoD Directive S-5100.30 in October 1962, entitled “Concept of Operations of the Worldwide Military Command and Control Systems (WWMCCS).” This directive set overall policies for the integration of the various command and control elements that were rapidly coming into being, stressing five essential system characteristics: survivability, flexibility, compatibility, standardization, and economy. The WWMCCS directive, though revised and declassified in December 1971 as DoDD 5100.30, was allowed to remain in effect despite the fact that Lieutenant General Albert J. Edmonds, Director, Defense Information Systems Agency, officially deactivated the WWMCCS Inter-computer Network (WIN) on August 30, 1996. One could thus argue that for nearly 10 years (until January 2006 when a revision was finally adopted) we had been without a C2 Policy directive - whether this was a help or a hindrance is debatable. If we return to the origins of Commanders issuing orders and expecting military competence from their subordinates, the implication was really Command and Trust all along. This is not a new concept. Nearly every great leader in the history of warfare has had similar thoughts:

“Leaders must establish a high spirit of mutual trust among subordinates and with their peers and superiors.” “Leaders must encourage creativity, freedom of action and innovation among their subordinates ...” *Attila The Hun* [Roberts, 1989]

“Our armies were composed of men who were able to read, men who knew what they were fighting for ...” “... as good soldiers as ever trod the earth ... because they not only worked like a machine but the machine thought.” Ulysses S. Grant [Kaltman, 1998]

Even God gave us only 10 Commandments. “The Ten Commandments contain 297 words, the Bill of Rights 463 words, and Lincoln's Gettysburg Address 266 words. A recent federal directive regulating the price of cabbage contains 26,911 words.” [An article in the New York Times]

“Use your people by allowing everyone to do his job. When a subordinate is free to do his job, he perceives this trust and confidence from his superiors and takes more pride in his job, himself, and the organization’s goals and objectives. Delegation of sufficient authority and proper use of subordinates helps develop future leaders. This is a moral responsibility of every commander.”¹

2.0 So, What’s the Problem?

2.1 Can “Command & Control” Really Be Defined?

The definition of “Command & Control” (C2) is still being debated within the U. S. Department of Defense, allied and coalition militaries, the private sector and academia, and a consensus has yet to emerge [Curts, 2005]. As historically shown, striving for a common language, or lexicon in any domain tends to be difficult at best. It has been said that current terminology discussions are more closely aligned with technology issues than the real essence of Command, Control or Command & Control. The environment in which C2 operates is certainly important but the environment is used to support C2. C2 must adapt to, but not be driven by, the environment.

In its most basic form “Command & Control” was always meant to convey commander’s intent. That is, “what” to do, not “how” to do it. Successfully conveying such intent implies a shared understanding of “Command & Control” (i.e., the “domain”) amongst the participants and, more importantly, that the sharing of diverse information sources be interoperable and understandable throughout both the Information and Cognitive Hierarchies. It seems the basic form of Command and Control is being lost. Admiral Ernest J. King, USN, became the Commander in Chief of the U.S. Fleet in December 1941 and the Chief of Naval Operations in March 1942, holding both positions through the rest of World War II. He guided the Navy’s plans and global operations during WWII and saw the problem creeping in even then: “I have been concerned for many years over the increasing tendency—now grown almost to ‘standard practice’—of flag officers and other group commanders to issue orders and instructions in which their subordinates are told ‘how’ as well as ‘what’ to do to such an extent and in such detail that the ‘Custom of the service’ has virtually become the antithesis of that essential element of command—‘initiative of the subordinate.’” [NDP, 1995].

Since the inception of Navies, the maritime service has allowed and encouraged ships and their commanders to operate as autonomous units. Early in naval history this was, of course spawned by necessity – once a ship left port, communication was virtually non-existent — sparse at best. However, even in today’s navies, commanders are given orders before they embark and are expected to carry-out those orders, handling unique circumstances along the way, using the training, experience, judgment and wisdom that won them command in the first place. Perhaps what is needed today is a little more focus on the human aspects of Command and a little less Control.

¹ From “Command of a Divisional Infantry Battalion in CONUS”, Battalion Commanders, Chapter 5, as quoted from Department of the Army Pamphlet 600–65 Personnel—General Leadership Statements and Quotes. Headquarters, Department of the Army, Washington, DC, 1 November 1985

What is Command & Control? As simply as possible, Command & Control has been historically defined as the actual process of directing and controlling forces. It is the authority that a commander exercises over his subordinates by virtue of his rank or assignment. A generic Command & Control process is depicted in Figure 1 below [IWIP, 1996].

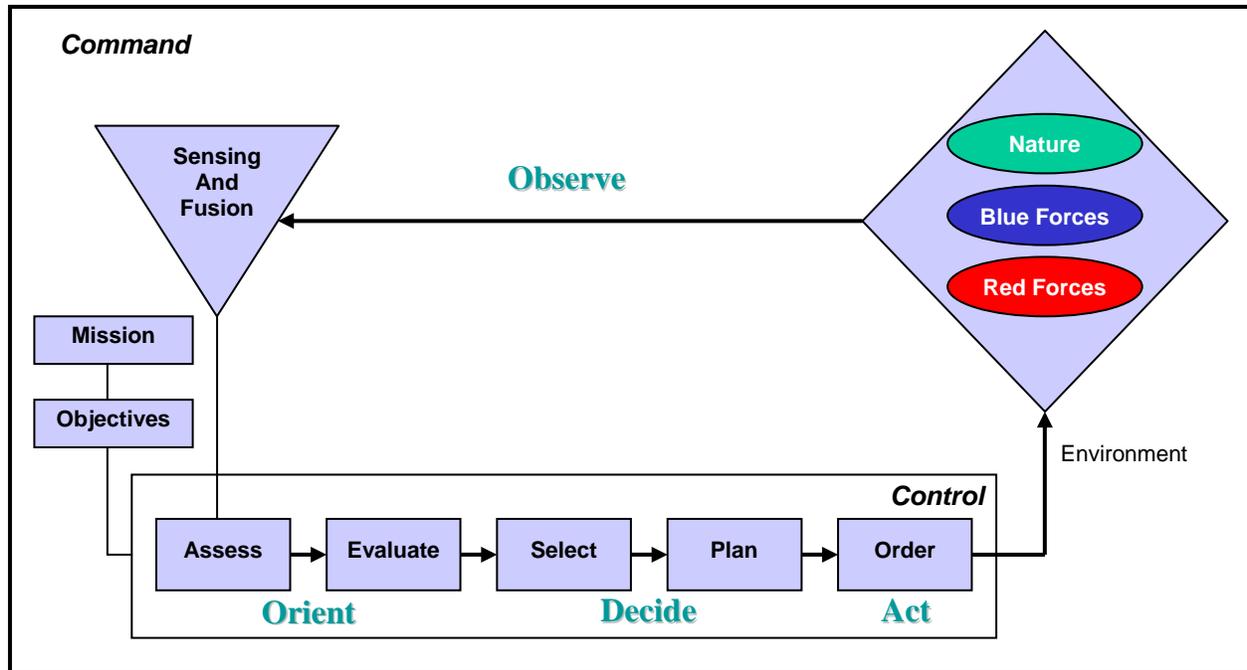


Figure 1. A Generic Command and Control (C2) Process.

As defined in U. S. Joint Chiefs of Staff (JCS) Publication 1-02, Command & Control is “the exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of the mission.” Command & Control is performed through an arrangement of personnel, equipment, communications, facilities and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission [JP 1-02, 1994].

Previously at a Command and Control Conference in Canada [Pigeau, 1995], at the Second International Command and Control Research and Technology Symposium (ICCRTS) in the United Kingdom [McCann, 1996], and at the 1999 CCRTS at the U.S. Naval War College in Newport, Rhode Island [McCann, 1999], Carol McCann and Ross Pigeau offered definitions that highlight the human aspects of Command and relegate Control to more of a support function:

“Command: *The creative expression of human will necessary to accomplish a mission.*”

“Control: *Those structures and processes devised by Command to manage risk.*”

“Command and Control: *The establishment of common intent to achieve coordinated action.*”

Similarly, NATO definitions include [NATO, 1988]:

“Command: The *authority* vested in an individual of the armed forces for the direction, coordination, and control of military forces.”

“Control: That *authority* exercised by a commander over part of the activities of subordinate organizations, or other organizations not normally under his command which encompasses the responsibility for implementing orders or directives.”

“Command and Control: The exercise of *authority* and direction by a designated commander over assigned forces in the accomplishment of the force’s mission. The functions of command and control are performed through an arrangement of personnel, equipment, communications, facilities and procedures which are employed by a commander in planning, directing, coordinating and controlling forces in the accomplishment of his mission.”

At issue here is that the term “Command & Control” may need to be redefined, or that it is simply no longer applicable in this age of agile organizations and counterinsurgency groups. The consequences of recent warfighting actions have led some to believe that the role of C2 is being eroded by the advent of huge databases, ubiquitous networked services and instant information, a cultural clash between the younger officers and their older superiors, trust at an enterprise level (joint or coalition), or any number of other possibilities. In short, traditional Command & Control works well in a military system designed to be controlled, pre-programmed and centralized. Moving as we have, to a military that is also becoming more dependent upon automation, will require it to replace control, pre-programming, and centralization with autonomy, emergence, and distributedness. Otherwise, the authors suggest that “Command & Control” is a relic in today’s modern warfare environment.

The U.S. Marine Corps has already opted out of the traditional view of command and control. They no longer teach “command” and “control” as operating in the same direction: that is, command and control from the top-down (See Figure 2). The top-down approach implies that commanders impose control on those under their command; commanders are “in control” of their subordinates, and subordinates are “under the control” of their commanders. Rather, the Marines teach a different and more dynamic view of command and control which sees command as the exercise of authority and control as feedback about the effects of the action taken (as also depicted in Figure 2). The doctrine now taught is that the commander commands by deciding what needs to be done and by directing or influencing the conduct of others. Control takes the form of feedback—the continuous flow of information about the unfolding situation returning to the commander—which allows the commander to adjust and modify command action as needed. Feedback indicates the difference between the goals and the situation as it exists. Feedback may come from any direction and in any form—intelligence about how the enemy is reacting, information about the status of subordinate or adjacent units, or revised guidance from above based on developments. Feedback becomes the mechanism that allows commanders to adapt to changing circumstances—to exploit fleeting opportunities, respond to developing problems, modify schemes, or redirect efforts. In this way, the Marines are taught that feedback “controls” subsequent command action. In such a command and control system, control is not strictly something that seniors impose on subordinates; rather, the entire system comes “under control” based on feedback about the changing situation.

Command and control is thus an interactive process involving all the parts of the system and working in all directions. The result is a mutually supporting system of give and take in which complementary commanding and controlling forces interact to ensure that the force as a whole can adapt continuously to changing requirements.

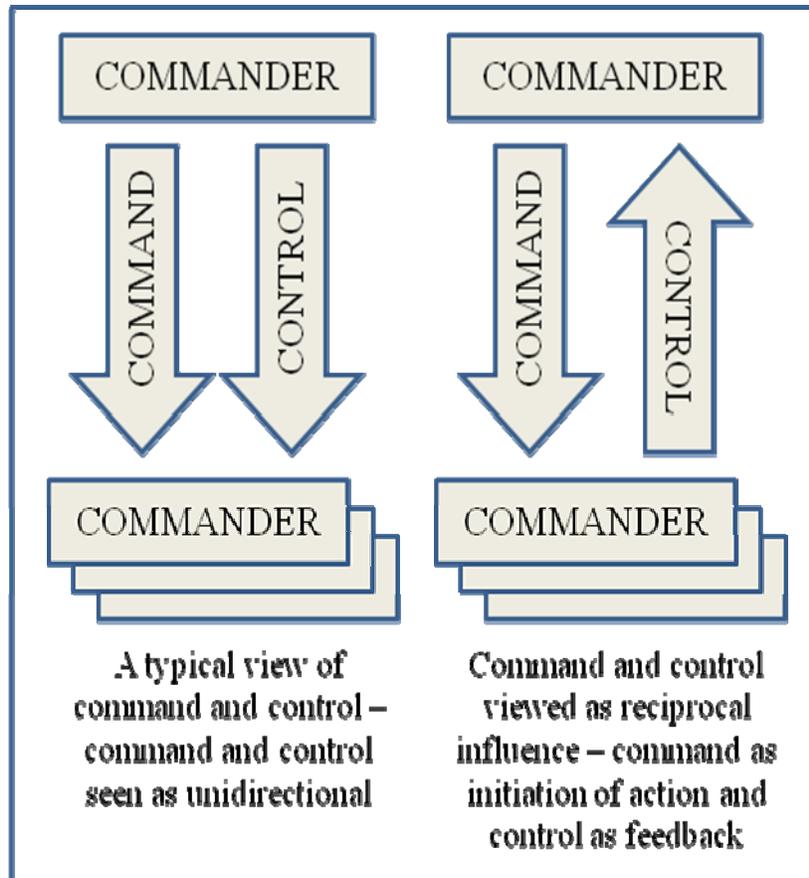


Figure 2. Two views of the relationship between command and control [MCDP 6].

Today, Command & Control continues to mean different things to different people; and is confusing to those warfighters in the field who have been taught different variations of the same doctrine. Meanwhile, our adversaries are making our Command & Control processes less and less effective. The authors believe we need a different mindset, a different set of processes to create more flexible warfighting efforts. The authors call this new approach “Command & Trust” (C&T) and, similar to the doctrine taught in MCDP 6, our view of the relationship between command and control looks something like Figure 3.

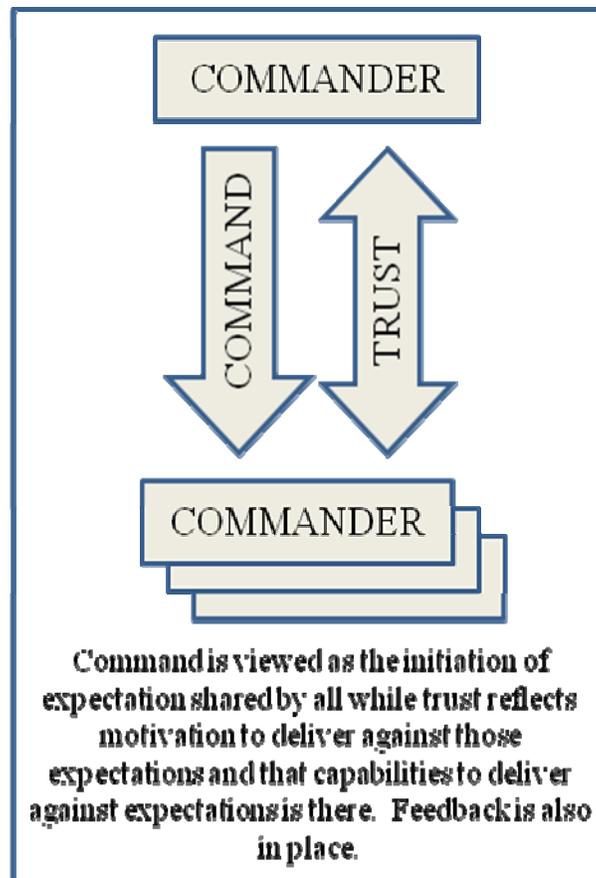


Figure 3. Authors' view of the relationship between Command and Trust.

2.2 *The Components of Trust*

The Command & Trust approach should not start with the assumption that all parties can or should be trusted. If only for security reasons, quite the opposite is true. The Command & Trust approach begins with the assumption that trust must be actively built and maintained. This becomes one of the key challenges for the chain of command: the element of choice and the ever-changing rotation of personnel. Who do you trust; why do you trust them; how fast do you get to trust or not trust them; what information do you or don't you trust, must you always trust your superiors and follow their orders, etc.

What is required to build and maintain trust? Four broad elements must be addressed.

- a. Mission-specific expectations must be shared by all parties.
- b. All parties must be sufficiently motivated to deliver against expectations.
- c. All parties must have the requisite capabilities to deliver against expectations.
- d. Notification mechanisms must be in place to provide early warning of any potential shortfalls in performance or abuse of privileged access. This feedback loop must run in both directions.

In a battlespace environment, trust must be proven as fast as possible. We can use Colonel John Boyd's OODA concept to show trustworthiness as the element of motion residing in the minds of humans:

Machines don't fight wars. Terrain doesn't fight wars. Humans fight wars. You must get into the mind of humans. That's where the battles are won.

Col. John Boyd

Common sense should tell us that a fighter aircraft with better maneuverability and similar speed characteristics should generally win the majority of "dog fight" engagements. However, this was not happening in actual air-to-air engagements during the Korean War. U.S. fighter pilots, despite flying aircraft with wider turn radii, were consistently beating adversary pilots and their aircraft. Based upon an in-depth study of the aircraft, Colonel John Boyd came to the conclusion that he was studying the wrong thing! It was not necessarily the characteristics of the aircraft that was the deciding factor in winning a "dog fight" - or at least not the only factor. It was the ability of the U.S. pilot to acquire the adversary first, and the speed with which the pilot's decision-making inputs reached the aircraft's control surfaces. Boyd's hypothesis was that a U.S. fighter pilot would win the "dog fight" because he could complete "loops" of decision-making faster than his adversary [Boyd, 1986]. Colonel Boyd's loop occurred in four distinct steps (See Figure 4).

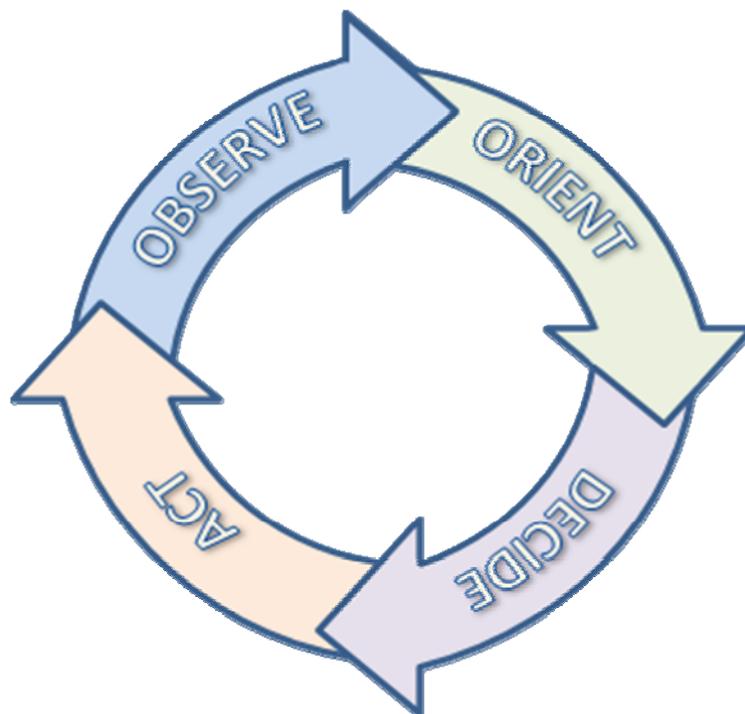


Figure 4. COL Boyd's OODA Loop Used in the Command & Trust Approach.

- **Observe.** During the Korean War, Boyd noted that U.S. pilots could see their adversaries better and more completely because the cockpit designs of U.S. aircraft ensured better visibility. As a Command & Trust element, today's Commanders would have to trust that all the information they are seeing on

- their monitors is correct from a Command aspect. The warfighter must trust that what they are observing using their “Mark 1 Mod 0” eyeball or through electronic means is, in fact, the truth.
- **Orient**. Boyd noted that since the U.S. pilots acquired their adversary first, they could then begin to orient themselves toward the adversary first. With respect to Command & Trust, today’s Commanders must stay out of the way and allow their subordinates in the field to take appropriate action based upon their training, skill and first-hand knowledge of the situation.
 - **Decide**. Boyd observed that after reacting with their initial orientation, the U.S. pilot’s level of training then allowed them, as a decision-maker, to act faster in proceeding to the next combat maneuver. Commanders must trust that the training provided their subordinates was adequate to allow them to deal with any situation that they are likely to face
 - **Act**. With the next combat maneuver decided upon, Boyd noted that the U.S. pilots could then rapidly “input” aircraft control instructions, with the resultant faster initiation of a desired maneuver before their adversary could react. Commanders today must, once again, relearn to stay out of the way and allow trusted subordinates to handle the situation appropriately while supporting them and their decisions as necessary. After all, commanders are responsible for maintaining an adequate level of troop training to accomplish whatever mission is assigned. If the troops haven’t been well-trained in the first place, the Commander should be held accountable for any failures in mission accomplishment. Admiral Ernest J. King saw his responsibilities a little differently than most: “If a ship has been sunk, I can't bring it up. If it is going to be sunk, I can't stop it. I can use my time much better working on tomorrow's problem than by fretting about yesterday's. Besides, if I let those things get me, I wouldn't last long.” [ThinkExist, 2007]

Based on these observations, Boyd’s OODA Loop model of air-to-air combat was useful to the Air Force. His model also worked its way into the U.S. Army through the maneuver warfare writings of William F. Lind [Bateman, 1998]. Lind, in his writings on ground combat and the role of maneuver in ground combat, re-oriented Boyd’s OODA cycle and used it as a tool to describe how U.S. forces might be able to more efficiently prosecute ground combat. The OODA Loop thus became the method used to describe the process by which ground combat formations might be able to fight the adversary more efficiently by moving quicker through the OODA Loop. Both Boyd and Lind postulated that if U.S. commanders could see, think and then act faster than their adversaries, they could hit their adversaries before they were ready, or place them into a position which they were not prepared to accept. A similar scenario during Vietnam prompted the establishment of the Navy Fighter Weapons School at Naval Air Station Miramar, CA, on March 3, 1969 – a.k.a. TOP GUN.

A U.S. Navy study (sometimes referred to as the “Ault Report”) was demanded by the Chief of Naval Operations (CNO) because of the less-than-desired performance of fighter aircraft, aircrews and weapons over Vietnam. The head of the study group, CAPT Frank Ault recommended that a graduate-level school be established to train fleet fighter pilots in air combat tactics to improve the relatively poor air combat performance of Navy aircrews over Vietnam.

Its objective was to develop, refine and teach Air Combat Maneuvering tactics and techniques to selected fleet air crews.

In 1968, the American advantage in air-to-air kills to losses had fallen to a mere 1.4:1. During the halt in the bombing campaign against North Vietnam (in force from 1968 until the early 1970's), TOP GUN established itself as a center of excellence in fighter doctrine, tactics and training. By the time aerial activity over the North was resumed, every Navy squadron had its share of TOPGUN graduates. The results were dramatic as the Navy kill-to-loss ratio or exchange rate against the North Vietnamese Air Force (NVAF) MiGs went from an average 4:1 (from 1965 to 1968) to over 20:1 before ultimately settling at 12.5:1 (overall from 1969 to 1973). [AFJI, 1974].

It appears appropriate to assume that the OODA Loop model could indeed be re-oriented and used as a tool to speed up the trustworthiness in a Command & Trust environment, a concept that was first introduced to the U.S. Navy by the authors in 1996.

In its most basic form, one can see that today's fighter pilots and ground troops are not the only ones who can perform the functions of "observe, orient, decide, and act" to prosecute military operations. History shows us that even Alexander the Great was better at analyzing, deciding, and controlling his engagements—and he prevailed in nearly every conflict. To master the OODA Loop from a Command & Trust approach, decision-makers must be able to trust the technology, information, equipment and people supporting the mission. Technology has the ability to mature the concept of the OODA Loop in a Command & Trust environment far beyond what Boyd had ever envisioned. But this technology now forces us to solve at least one fundamental challenge if we expect to implement a Command & Trust approach within the battlespace. That is, the explosion of available data creates an environment within the cognitive hierarchy that could easily lead to information overload thus spawning flawed decision-making that, ultimately, results in untrustworthy environments. Working in an untrustworthy environment is commensurate with falling back into a Command & Control approach.

The challenge is to harness that combat information explosion, thus improving decision-making and increasing the "gut feel" of trustworthiness around the warrior. Recent exercises reveal an alarming number of unread messages, email and other such communications because of information overload. As the quantity of data rises, the difficulty of preparing, disseminating, digesting, interpreting and acting upon it grows. Traditionally, the military attempted to solve this problem by increasing the number of communications nodes. These past solutions only injected additional inputs and information without improving decision-making capability. The optimum solution must integrate the functions within the OODA Loop and give the decision-maker the correct dataset filtered through the cognitive hierarchy. As will be discussed in more detail later in this paper, using this methodology should establish a viable Command & Trust approach set on a solid foundation.

To gain advantage over the adversary's own OODA Loop, the decision-maker is faced with the problem of shortening the life-cycle of the decision-making process without losing trust. That is, without increasing the failure rate of the decisions being made. Simply, the decision-maker needs to place a higher degree of trust in the battlespace picture before him or her and

before the adversary places his or her trust in their picture. This “perceptual” input will come from many sources and will begin to form a picture in the mind of the decision-maker. The picture that is forming (data) will then be used to obtain information (forces, systems, tactics, etc.), and analysis of that information will then be used to gain knowledge (e.g., force placement), awareness (adversary intent), and understanding (what direction will the engagement take next).

One can sense that the loss of trust in any one part of the OODA Loop would not only slow down that portion of the Loop but would, by default, slow down the entire process, no matter how much trust is placed on the other elements of the Loop. That is because of the cyclic nature of the Loop – it is only as fast as the slowest, most untrustworthy element.

Spanning all steps in the OODA cycle is the term “truth telling.” The truthfulness both down and up the chain of command is the surest lubricant known against internal friction in military operations. Policies, practices, culture, and command climate have to reward it, not punish it. They must make it *safe* to tell the truth. If there is no reliable safety for telling the truth, the most Draconian punishments for lying or silence, the most elaborate “screening” for character will not produce military truth-tellers. Whatever causes “risk aversion,” “career fear,” “courtier skills,” or a “climate of fear,” lack of truthfulness is like a steady blood-loss from *everyone* in an organization. Trust makes consistent truthfulness possible; consistent truthfulness makes well-founded trust possible. There is no way out of this circularity [Vandergriff, 2001].

General George S. Patton Jr. summed it up:

"No one is thinking if everyone is thinking alike. In too many organizations, toadyism is buried like a cancer. It must be removed with the sharpest bayonet available. All sorts of suggestions, ideas, concepts, and opinions must be allowed to promote an environment of learning and imagination. A fault of many potentially fine commanders is a lack of the ability to admit that other people have good ideas. If younger Soldiers are not allowed to use and cultivate their imaginations and their abilities for abstract thought, where will we get the next generations of qualified, motivated, and confident commanders? Commanders who never ask for an opinion, never listen to suggestions, and think they have the only correct idea find that their Soldiers will stop communicating altogether. They'll begin to sit on their asses and wait for orders before doing anything. No matter how high in the ranks a man goes, he can't know everything. We can always learn from each other. Juniors must learn not only to be allowed to use their imaginations, but they must be encouraged to do so."

"Furthermore, no leader knows it all (although you sometimes find one who seems to think he does!). A leader should encourage the members of his staff to speak up if they think the commander is wrong. He should invite constructive criticism. It is a grave error for the leader to surround himself with a 'yes' staff." – GEN Omar Bradley

The Command & Trust approach is therefore affected by a growing deluge of data that are insignificant or not applicable to the task at hand. The difficulty lies in being able to percolate up through the cognitive hierarchy the exact bits and bytes of data that are useful. This

filtering process can be pictured as a pyramid with the wealth of “data” laying the broad foundation for what will eventually reach the top—wisdom that comes from having filtered the right data. Unfortunately, most military decision-makers possess limited time (driven by the OODA Loop) to ensure complete trust. They must still perform specific tasks and issue orders even as trust erodes. This is especially evident during warfighting exercises and operations. Further, as increased volumes of data are input into the base of the pyramid or as the rate of input increases, natural defense mechanisms try to protect the decision-maker from information overload [McKittrick, 1995]. A key method is a “bounded rationality” that allows decision-makers to screen out inputs prior to being overloaded or inundated so that they can continue to focus on a particular task [Simon, 1976]. One danger lies in the decision-maker screening out “golden nuggets” because their attention is focused elsewhere. A second danger lies in failing to recognize when new data should dictate a refocus or reorientation that will regain trust. As we mentioned earlier, recent operational exercises revealed an alarming number of unread messages, email and other such communications that might have guided that recognition. A quick review of the authors perception of the “cognitive,” or in the case of military operations, “Command,” hierarchy follows (Figure 5).

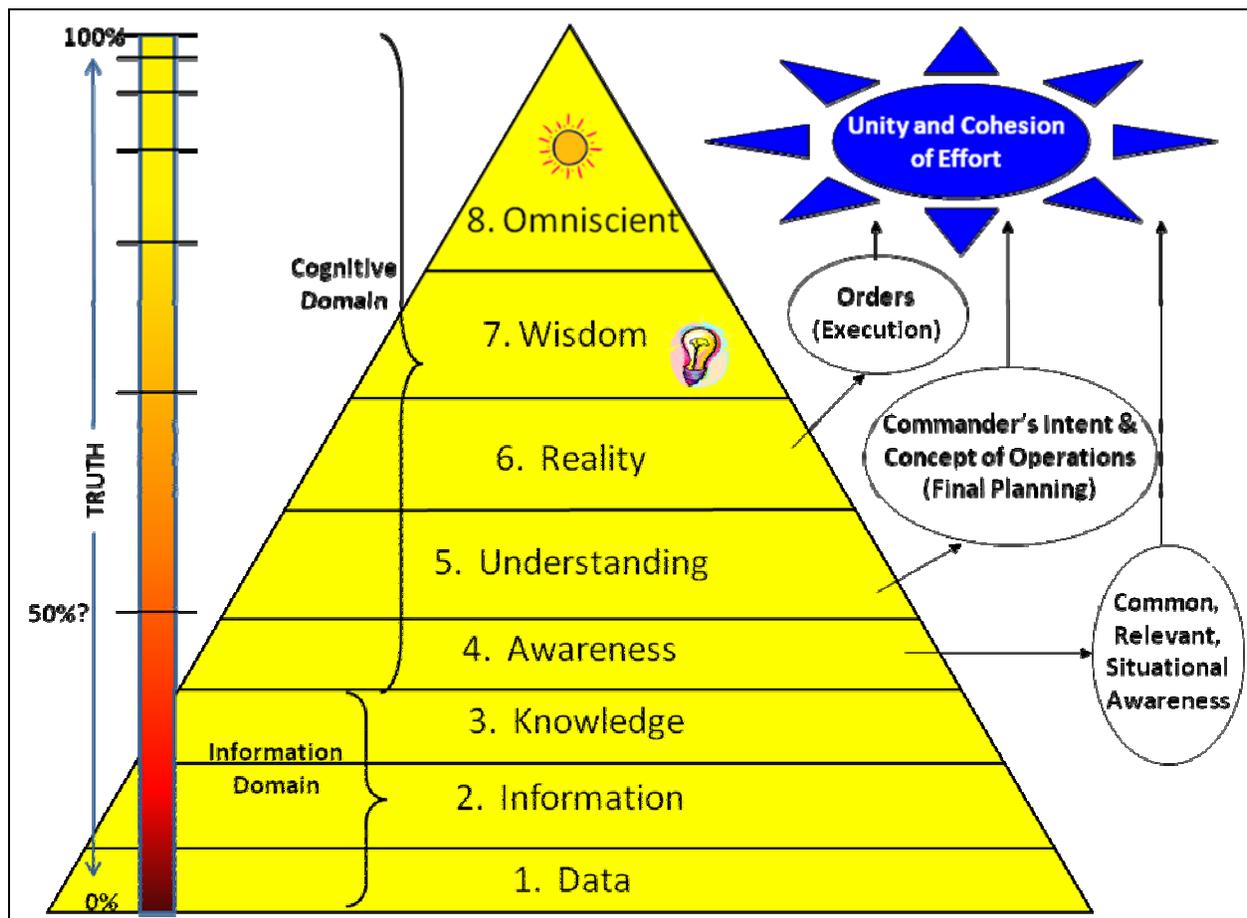


Figure 5. Command Hierarchy.

- Level 1: Data – Raw data is collected, and thus observed, from one or more sources. These data can eventually be augmented by rules imbedded in an

- expert system, or through population of large, separately maintained data structures. To reach the next level the data must be organized into information that is recognizable within the context of human experience. In other words, data correlated becomes information.
- Level 2: Information – Data organized into some form that is useful to a human operator can be reported in a meaningful, recognizable form. To attain the next level, one must be able to fuse / integrate multiple information sources to form knowledge. In other words, fused information from multiple sources becomes knowledge.
 - Level 3: Knowledge – Information fused from multiple sources integrated with common, environmental context. To attain the next level, one must add real world experience to arrive at awareness. In other words, specific knowledge orients the decision-maker in real world settings and is used to predict the consequences of actions. This leads to awareness.
 - Level 4: Awareness – Real world knowledge in context. That is, the decision-maker is forming a personalized view of the situation(s) requiring attention. The formulation will eventually allow the decision-maker to make sound decisions. The awareness begins without external input from others; when input from others begins to register we have understanding (given the proper training) or confusion.
 - Level 5: Understanding – An individual's perception of reality based on forming a picture in his/her mind (sometimes referred to as having "The Big Picture"). This "Big Picture" is a balance between one's own personal "view of the world" and the perceptions and inputs of those having close contact with the decision-maker (e.g., analysts and tacticians). This is as close as the decision-maker gets to comprehending the situation(s) around him/her and later being able to measure those situations against reality (Level 6). This is where the decision-maker takes action.
 - Level 6: Reality – This is the "real world." The closer that the decision-maker's "Big Picture" matches when overlaid onto the picture of the real world, the better the decision-making. Insight progresses from reality to wisdom. Reality, of course, includes the world of those not in close contact with the decision-maker (e.g., strategists, politicians) and information about which he may not be aware. At this point we are back in observation mode to determine the results of our actions and to see how well our awareness matches the reality. "Lessons Learned" are usually derived at this point in the OODA loop.
 - Level 7: Wisdom – This encompasses a deeper understanding of real world constructs coupled with intellect, instinct and intuition. The decision-making events at this level become textbook cases in how to master the shortening of the OODA Loop to overcome any adversary [Curts, 2001].

Note the logarithmic bar along the left-hand side of Figure 5 that is depicting trust. The percentage, or degree, to which participants are trusting of each other and the products and services that are provided potentially affect transactions across the information, cognitive and social domains. The objects of trust are varied. They include individuals, organizations and

information collectors, as well as equipment and systems. Individuals and organizations will be perceived and may be stereotyped by role or function. For example, differing degrees of trust may be an initial default depending on whether the relationship is superior-to-subordinate, peer-to-peer, or organization versus organization. [Varying degrees of trust] will affect how participants perceive information provided by others and their willingness to be dependent on others for support. [Varying degrees of trust] should also be expected to affect the nature of collaborative arrangements [Alberts, 2006].

Technology can integrate the functionality of trust within the OODA Loop and speed up the cycle. It does this by creating decision support tools to alleviate the doubtful situation that exists when crucial nuggets of information are omitted from the individual's awareness. The tools aid in managing information to fit how decision-makers actually form a picture in their minds, assess situations, and then issue orders [McGinnis, 1994]. One downside is that the decision support tools will absorb inputs from a large variety of different, sometimes contradictory, ambiguous or incremental sources, thus magnifying the distrust felt by the warfighters in the field about their Command & Control staff. Another downside is that officers who voice or publish their displeasure with decisions being made at the higher levels will suffer the consequences of such actions. Such is the case of those in the U.S. military fighting in Iraq.

As many in the military publicly acknowledge for the first time, the guerrilla insurgency that exploded several months after Saddam's fall was not foreordained. In fact, to a shocking degree, it was created by the folly of the war's architects. But the officers who did raise their voices against the miscalculations, shortsightedness, and general failure of the war effort were generally crushed, their careers often ended. A willful blindness gripped political and military leaders, and dissent was not tolerated [Rich, 2006]

Army Lt. Col. Paul Yingling served in Iraq and subsequently published an article in the May 2007 issue of the Armed Forces Journal entitled "The Failure of Generalship." In the article he questions the ability of Generals to successfully fight the Iraq War – mostly because they are trapped in the traditional Command & Control mode of warfighting. One response to the article was: "I think [Col. Yingling] was speaking some truths that most of us talk about over beers," says Col. Matthew Moten, a history professor at West Point who also served in Iraq. "Very few of us have the courage or the foolhardiness to put them in print." [Jaffe, 2007]

How do we go about changing our military culture to develop great generals and reward the moral leadership we expect? Our own military history offers a solution to the current crisis and perhaps the only one that can truly effect cultural change. In the buildup to World War II, newly appointed Army Chief of Staff Gen. George C. Marshall faced a similar dilemma. Marshall inherited a stable of generals who were part of the "good ol' boy" network and a culture that Marshall did not believe was suited to meet the monumental challenges that faced the Army. He solved it by firing a large number of them, replacing them with a new generation of young, talented field-grade officers who understood the emerging types of modern warfare in which they would have to fight and win. The result was the emergence of a group of strong, innovative generals who won the war and led us into the position of superpower we still enjoy [Mauk, 2007].

2.3 *The Role of Sensemaking*

The XEROX Palo Alto Research Center (PARC) is involved with studies on sensemaking. They define it as “The process by which individuals (or organizations) create an understanding so that they can act in a principled and informed manner. Sensemaking tasks inherently involve an embodiment as an actor (or actors), an environment, forms of knowing, and ways to work with what is known. Working can take different forms — such as logical, metaphorical, physical, or image-based reasoning.” [PARC, 2007]

The study of sensemaking relative to group, team, or collective sensemaking dynamics is beyond the scope of this paper, but individual sensemaking from a trust standpoint has been reviewed by the authors. In summary, individuals will, over time, develop mental models that determine how they perceive and understand information. They also invariably develop perceptual filters and biases (e.g., trust or distrust) that affect how they interpret and understand information, as well as how they interact with others and how they behave in specific situations. The cognitive state of an individual at any point in time also affects their ability to process information. Stress and physical conditions contribute to this state. Education, training and experience play an important role in determining how efficiently and effectively individuals perform this function in a variety of circumstances. Whether an individual trusts or has confidence in a particular piece of information is influenced by perception of the source, the security of the information system, and by other *a priori* perceptions and understandings that influence the individuals perception of the situation and impact the sensemaking process [Alberts, 2006].

2.4 *The Role of Intuition / Gut Feel*

“There are ... two important lessons here. The first is that truly successful decision making relies on a balance between deliberate and instinctive thinking. The second lesson is that in good decision making, frugality matters. [Klein, 1998]

Modern C4I systems are feeding huge amounts of information to decision makers who process, interpret and display the information on maps and status reports. Such situational presentations are generated by computers, and displayed at the Command Posts (CP) on large screens or relayed to remote subscribers, via high speed networks. The system is maintained as “liquid information” in database format, which separates the data from the viewing space. This method enables faster visualization and optimal maintenance of large volumes of constantly changing information. The system gathers real-time and near-real-time feeds from multiple intelligence and C2 applications. Constant monitoring of the battlefield is provided, by tracking the combat elements on maps or satellite photos and video feeds from battlefield sensors, following enemy forces through intelligence reports, ground observations, forward units or Unmanned Aerial Vehicles (UAVs). Commanders no longer have to call on the radio to check the status of each unit.

While this is certainly a step forward in the technology of information handling, analysis and traditional decision support, does it actually improve decision-making? Noted author and

leading expert on intuition and decision-making, Gary Klein, casts doubt on the effectiveness of such systems to improve decision-making, especially in high stress, time sensitive situations. *“Information technology can diminish the active stance found in intuitive decision makers and transform them into passive system operators. Information technology makes us afraid to use our intuition; it slows our rate of learning because we are too timid to explore new strategies.”* [Klein, 2003]

Dr. Klein also identifies sources of uncertainty: *“The five sources of uncertainty are missing information, unreliable information, conflicting information, noisy information and confusing information.”* One might conclude that added information may actually increase uncertainty rather than alleviating it. [Klein, 2003]

“... information technologies are taking their toll. ... decision aids and smart systems are reducing their operators to clerks.... Operators come to passively follow what the information technology recommends rather than relying on their intuition.”

Is it possible that we have taken Information Technology a bit too far?

For years we have focused on increasing the quality and quantity of information available to decision makers in the belief that the more we know the better our ability to reach intelligent, informed, reasonable and, most importantly, effective decisions. The Goldman algorithm, developed by Dr. Lee Goldman while studying medical diagnostics in the 1970s, says: *“Quite the opposite: that all that extra information isn’t actually an advantage at all; that, in fact, you need to know very little to find the underlying signature of a complex phenomenon. In fact, ... extra information is more than useless. It’s harmful. It confuses the issues. What screws up [decision makers] ... is that they take too much information into account”* [Gladwell, 2005].

3.0 Summary / Conclusions

The authors believe that a Command & Trust approach offers significant promise in creating mission success in a battlespace recently characterized by an agile and mostly invisible adversary and by growing uncertainty in the way warfighters are to respond. Properly applied, the Command & Trust approach enables Commanders to achieve a much higher level of collaboration and flexibility than would ever be possible with the less flexible Command & Control based approach.

For example, “... the thing the Army institutionally is still struggling to learn is that the most important thing we do in counterinsurgency is building host nation institutions – building security forces, building local government capacity – and yet all our organizations are designed around the least important line of operations: combat operations. There is a real danger in over-determination based on the organization’s design. There’s the old saying, ‘If you give a man a hammer, he sees every problem as a nail.’ Similarly, if you give a unit tanks and Bradleys, they see every problem as a movement to contact. That’s an oversimplification, but it is a problem.” [McCool, 2006] Simply, as seen in “Lessons Learned” from Korea, Vietnam and Iraq, you don’t turn a combat force into a police force just because the mission may have changed.

Far from increasing vulnerability to the warfighter from unanticipated events, the Command & Trust approach actually reduces vulnerability. The Command & Trust approach, however, requires a far different set of capabilities than most Commanders possess today. Because of the lengthy lead-times required to build these capabilities, Commanders should be advised to begin now in moving to the Command & Trust approach. Fortunately, the process for implementing the Command & Trust approach provides ample opportunity to build the capabilities without exposing the enterprise to undue risk.

There are two types of trust that can be identified and are of interest. One is *competence-based trust* which focuses on people's ability, expertise and competence to do a job and to know what they are talking about. The other type is trust based on benevolence. It is this type of trust that we most identify with (i.e., I know you will not think of me as ignorant when I ask certain questions, therefore, I am not afraid to ask these questions). This type of trust touches on our vulnerability and it is only when this type of *benevolent trust* is present that we can learn new things and grow both professionally and as individuals [Cross, 2004].

Three keys [in implementing Command & Trust] are in the hands of military line leaders and trainers and their seniors who set policy and create climate. These are: positive qualities of community (cohesion) of the service member's face-to-face unit, of which stability is the most important; competent, ethical, and properly supported leadership; and, prolonged, realistic, progressive, state-dependent training that works for what troops and their leaders really have to do and face. These are the things that build trust. [Shay, 1998]

"Never tell people how to do things. Tell them what to do and they will surprise you with their ingenuity." – GEN George Patton

4.0 Recommendations for Further Research

There are many challenges to the Command & Trust concept that need further research. Here are a few examples:

Challenge No. 1. *How can we better understand the concept of "shared expectations" between Commanders at Headquarters and Commanders in the field? How can "shared expectations" create shared understanding of mission expectation?*

The authors believe that trust ultimately depends upon a clear understanding of mission expectation. Within a Command & Control approach, Commanders at Headquarters can intervene at any time to clarify their expectations. In contrast, the Command & Trust approach requires a reasonable investment at the outset to ensure that expectations are appropriately set so that those in the field can proceed on their own initiative. This was pretty much the way military operations worked until Vietnam when the war began to be fought from the Oval Office. Over time in a Command & Trust environment, the parties get to know each other and understand the expectations of all involved. When that happens, less effort is required to ensure that this element is in place.

In the early stages of building trust relationships, Commanders need to ensure that all parties understand each other well enough to be able to establish shared expectations regarding the accomplishment of their mission. That is, “bark” may mean the stuff that grows on the outside of trees, a sound made by a dog, or a type of boat. Likewise, “secure a building” may mean different things depending upon your point of view. One possible solution may be an ontology. Discussing ontologies considerably broadens the scope of this paper; the interested reader is invited to review “Building an Ontology for Command & Control” which was presented at the 10th International Command & Control Research & Technology Symposium (ICCRTS) in June 2005 [Curts, 2005].

Challenge No. 2. *What incentives can we use to create the will to perform in a direction that is advantageous to both the organization and the individual?*

The authors believe that the best way to ensure that a Command & Trust approach will perform as expected is to create the right incentive structure to motivate appropriate behaviors. This is challenging enough within a single command and becomes even more challenging when the parties involved cross coalition or joint boundaries. Training, for example, will provide the “skill to perform,” but there needs to be incentives to create the “will to perform.” Designing the right incentive structure may be intuitive to those in a military command structure, but under a Command & Trust approach it requires a deeper understanding of the drivers and aspirations of each of the participants. Given the great diversity of participants it is probably impossible to implement a uniform incentive structure. Incentives may need to be tailored to meet the unique needs of each category of participant. For example, one category may be incentivized to make their next grade; another to just finish their tour; another to get their on-line degree, etc.

Challenge No. 3. *How can we focus on assessing, in a rigorous and objective manner, the relative skills of the various parties to deliver their expectation?*

The authors believe that incentive structures are a critical foundation for the Commander’s Command & Trust approach. Given the right incentives, military personnel will be strongly motivated to build and strengthen whatever capability is required to deliver to the successful accomplishment of the mission. Having said that, Commanders must also focus on assessing, in a rigorous and objective manner, the relative capabilities of the various parties to deliver. This is the key to the process of setting realistic expectations at the outset. If the gap between required capability and actual capability is too wide, no amount of reward can bridge that gap, especially in the tactical or near-tactical timeframes.

Audits, enlisted evaluations and officer Fitness Reports should provide valuable evidence of capability and, just as importantly, highlight gaps in capability. But that system is broken. In implementing a Command & Trust approach, Commanders may need to address capability gaps by adding more specialized personnel that can complement the original military structure or cross-train the original structure of personnel. The Command & Control approach tends to resist adding more military personnel toward completing a successful mission because of the significant management complexity associated with additional personnel. By adopting a

Command & Trust approach focused on successful mission completion, additional military personnel can be more readily accommodated.

Challenge No. 4. How do we handle “unanticipated events”?

Even with the most compelling will to win and with the most extraordinary skills of a warfighting team, unanticipated events can, and frequently do, disrupt the battlespace. In some cases these may be acts of nature, as in the case of heavier-than-anticipated thunderstorms. In other instances these may be the malicious acts of insurgents, hackers or even common criminals. Command & Control and Command & Trust approaches are both vulnerable to such disruptions.

If the reader agrees that everyone is vulnerable to such disruptions at some level of planning implementation, then the key question is: Is a Command & Trust approach more or less vulnerable than a Command & Control approach? It is the authors' contention that the Command & Trust approach has some significant advantages relative to the Command & Control approach – Command & Trust is more likely to reduce vulnerability, although neither would fully eliminate it.

Challenge No. 5. How do we find the courage and conviction to begin transitioning how Commanders operate – from the more traditional Command & Control environment to the new Command & Trust environment?

The authors believe that moving away from a Command & Control approach to warfighting to a Command & Trust approach will require a significant shift in a Commander's set of capabilities. This transition must include a shift in the Commander's thinking on how modern warfare must be waged. For that to occur, proper and formalized training needs to be architected and implemented; and that will require the Department of Defense to buy into this new concept of warfighting. The authors see at least four broad capabilities that must be developed in order for DoD to successfully train their Commanders to transition from Command & Control to Command & Trust:

- **Chains-of-Command Management.** No one goes to war by themselves anymore. And it's no longer a single chain-of-command. It's become an enterprise-wide set of chains-of-command that the decision maker has to deal with.
- **Command and Trust Skills.** Today Commanders rely heavily on the Command & Control structure to reinforce their decision-making efforts. These mechanisms are far less readily available in a Command & Trust approach. The challenge of issuing orders to be followed to the letter is greatly increased as the scope of issuing orders expands across multiple enterprises, each driven by different cultures and styles. Often, the Commander will have to wrestle with how to architect shared meaning as a prerequisite to issuing any orders.
- **Strategist, Tactician and Entrepreneur.** The first two items above reflect a traditional C2 approach; under a Command & Trust approach you also need to

be an entrepreneur – to weigh and take risks, even career risks – and that’s the biggest problem to overcome. That is, risk management within an entrepreneurial command structure where a majority of the command structure is dictated by outside authorities.

- **Knowledge Brokers.** Commanders are going to need the skills in understanding how knowledge can be built, not just across functional boundaries like a traditional Command & Control approach but across enterprise boundaries which will be more like Command & Trust. Knowledge-building is the key to creating a compelling and long-term Command & Trust structure. Sun Tzu (c. 544 BC – 496 BC), the author of *The Art of War* on military strategy, was right - which begs the question: Why do we keep invoking Sun Tzu’s name if we’re not going to take his advice?

Challenge No. 6. How do we build trust amongst all parties?

A Command & Trust approach cannot, and should not, emerge quickly. Ideally, it should be based upon a foundation of experience taught in the various military command & staff colleges; thus the teaching staff that is comprised mostly of current and retired senior military officers must be able to share their lengthy experience in the world of Command & Trust rather than the more traditional Command & Control. This will be successful when the teaching staff develops the confidence in the “will and skill” of the Command & Trust approach to pass on to the students. With that said, the military is an enigma – it prides itself on more than 230 years of tradition yet lives in a rapidly changing environment. Student soldiers do not have the luxury of waiting for educators to address them with that lengthy shared experience. We must find ways to accelerate the building of a Command & Trust approach while honoring the inherent traditional approaches also involved in warfighting education.

“...every single soldier must know, before he goes into battle, how the little battle he is to fight fits into the larger picture, and how the success of his fighting will influence the battle as a whole.” – Field Marshall Montgomery, as quoted in Combat Motivation: The Behavior of Soldiers in Battle by Anthony Kellett.

The authors believe that there are a few positive steps that can be taken now to get us closer to this concept of Command & Trust and back to basics:

1. Take steps to ensure that the C2 disasters of the past will not re-occur. The last thing we need is more tactical decisions made in the Oval Office, the Pentagon situation room or the Capitol.
2. Train and treat our decision makers as though we really believe the teachings of Mahan, Sun Tzu and the others we continually quote – not to mention our own principles.
3. Ensure that dissenting opinions are heard, discussed and seriously considered and that the offerors of those opinions are rewarded for their candor if not their ideas.
4. Our military personnel are trained to wage war, not act as a police force or a diplomatic body. Trust them to implement the military option and to secure the

battlefield, then get them out. Let others follow up with policing and/or more intense diplomatic actions.

At its most basic level, trust boils down to the character and moral courage of the individuals involved. While there are no easy answers, the authors believe that getting back to the concepts that we are all taught early in our military carriers – i.e., “Take care of your boss and trust that your boss will take care of you.” – would be a good start.

Acronyms

| | |
|----------|---|
| AFJ | Armed Forces Journal |
| ASD(C3I) | Assistant Secretary of Defense, Command, Control Communications and Intelligence – renamed ASD(NII) |
| ASD(NII) | Assistant Secretary of Defense, Networks and Information Integration – formerly ASD(C3I) |
| AWG | Architecture Working Group |
| BG | Brigadier General |
| C&A | Certification and Accreditation |
| C&T | Command & Trust |
| C2 | Command and Control |
| C4 | Command, Control, Communications, and Computers |
| C4I | Command, Control, Communications, Computers, and Intelligence |
| CCRTS | Command & Control Research & Technology Symposia |
| CDR | Commander |
| CONUS | Continental (or Contiguous) United States |
| DoD | Department of Defense |
| FitRep | Fitness Report |
| GEN | General |
| HQ | Headquarters |
| JCS | Joint Chiefs of Staff |
| ICCRTS | International Command & Control Research & Technology Symposia |
| LCDR | Lieutenant Command |
| LTCOL | Lieutenant Colonel |
| MCDP | Marine Corps Doctrinal Publication |
| NATO | North Atlantic Treaty Organization |
| OODA | Observe, Orient, Decide, Act |
| USA | United States Army |
| USAF | United States Air Force |
| USD | Under Secretary of Defense |
| USMC | United States Marine Corps |
| USN | United States Navy |

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Acknowledgements

The authors would like to acknowledge the special contributions to this paper by three distinguished professionals.

The section on command and control failures within coalition environments (under Section 3.5 of this paper) was written by LCDR Todd C. Wilson, USN. This section was originally published in his thesis “The Unsolved Mystery of Coalition Command and Control” which was submitted to the Faculty of the U.S. Naval War College (NWC) in Newport, RI, in partial satisfaction of the requirements of the JMO Department. The paper was released by the NWC on February 14, 2005. However, the contents of the paper reflect LCDR Wilson’s own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

John Hagel III is an independent management consultant whose work focuses on the intersection of business strategy and technology. His most recent book, Out of the Box: Strategies for Achieving Profits and Growth Tomorrow, was published by Harvard Business School Press, Boston, MA, in October 2002.

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While Messrs Hagel and Brown claim no military experience, their subsequent discussions with the authors on how commercial entities could be more efficient and effective using a different management style (trusting rather than controlling) proved to have similar characteristics to what the authors are presenting in this paper.

Vita

Raymond J. Curts, PhD, CDR, USN, (Ret.) was born December 2, 1946 in Philadelphia, Pennsylvania and is an American citizen. He graduated from Vandalia Community High School, Vandalia, Illinois in 1965. He earned his Bachelor of Science in Aeronautical and Astronautical Engineering from the University of Illinois in 1970 and was commissioned an Ensign in the United States Navy. In December 1972 he earned his wings as a Naval Aviator and was assigned to the U.S. Naval Base at Guantanamo Bay, Cuba. Returning to the continental United States in 1976, he served as an instructor pilot in the Navy's Advanced Jet Training Command in Beeville, Texas where he earned a Master's degree in Management and Business Administration from Webster University of St. Louis, Missouri. During tours of duty in Norfolk, Virginia; Rota, Spain; and Key West, Florida, he served as the A-3B NATOPS Model Manager (NMM), the Training Model Manager (TMM) and the A-3B Director of Training, and was responsible for all A-3B aircrew and maintenance training Navy-wide. CDR Curts' final tour was at the Space and Naval Warfare Systems Command Headquarters (SPAWAR) in Washington, DC where he spent five years as the Navy's Electronic Warfare Architect. During this time he earned a Ph.D. in Information Technology from George Mason University and retired from active duty in 1992. Since that time Dr. Curts has worked in support of numerous DoS and DoD programs as a defense contractor and has conducted a variety of studies in the areas of Information Architectures, Interoperability and Information Assurance. He was a primary contributor to the Navy's Information Warfare Master Plan and Acquisition Strategy and was responsible for a complete re-write of the U.S. State Department's Information Assurance Policies and Procedures. Later Dr. Curts supported the Director, C2 Policy at ASD(NII) on the DoD C2 architecture and the OSTP Continuity Communications Enterprise Architecture efforts, and later supported similar efforts for the Chief Information Officer in the Director of National Intelligence. He currently supports ASW Architecture development for the U.S. Navy, serves as an Adjunct Professor of Information Technology and Engineering at both George Mason and George Washington Universities, and is involved in standards making and investigative bodies associated with IEEE, NDIA, CCRP, ITAA, NIAP, AFCEA, and AOC among others.

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