

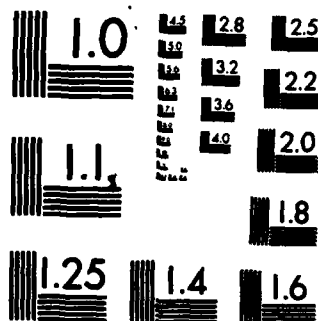
COMMAND AND CONTROL AS A FORCE MULTIPLIER-MYTH OR
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STUDENT ESSAY

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COMMAND AND CONTROL AS A FORCE MULTIPLIER- MYTH OR REALITY?

BY

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USAWC MILITARY STUDIES PROGRAM

INDIVIDUAL ESSAY

by

Colonel Orhan Tan

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ABSTRACT

AUTHOR: Orhan Tan, COL

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Command and Control (C2) capability establishes one of the most important aspects which deeply effects the combat effectiveness of the military forces. Unless a flexible, responsive, timely and survivable C2 System is established, commanders will not be able to conduct the operations successfully. Taking these realities into account, the study analyzes the tactical level C2 system, its elements and their contribution to the overall system. The study also examines the deficiencies of the current system and includes recommendations for a better C2 system.

I. INTRODUCTION

1. During particularly the last years Command and Control (C2) as a force multiplier has been a continuous subject for many military and civilian authors. Since the theme concerns both tactical and technical aspects, C2 establishes a most popular area to pursue by both civilian and military authors.
2. As it will be explained later, the reality of force multiplier is not new, and has always been thought over by the scholars. It is obvious that the western world, mainly NATO, is completely outnumbered by its counterpart, Warsaw Pact (WP). NATO-WP conventional force comparison in European theater reveals ¹ that WP outnumbers NATO 4 million to 2.6 million in manpower, 173 to 84 in divisions, 42.500 to 13.000 in main battle tanks, 24.300 to 8.100 in anti-tank guided weapon launchers, 78.800 to 30.000 in armored personnel carriers and infantry fighting vehicles. The comparisons between the land combat support elements and tactical air assets are not very much different than the above figures. Furthermore, it must be considered that these figures will be changed dramatically to the advantage of WP in case of war, specially because its militarily oriented industry and centralized administration.
3. Is it the only way for NATO to strike with nuclear means at the very beginning of a potential war which will inevitably result in massive destruction? The early use of nuclear weapons will not be considered as a valid strategy without resorting to the other available and possible resources. Therefore, if we don't desire an early nuclear escalation we have to increase our conventional war fighting capability.

4. If we agree on that strategy, then we must search for the possibilities to create a conventional force balance vis-a-vis the potential enemy. Of course there are various courses of action to this end. Some of them (without increasing the tangible combat power) can be: to develop and maintain the esprit-de-corps or morale of the troops, to create an extremely high level of training and combat readiness, to increase the C2 capabilities, to use the combat support and combat service support in the right place and in the right time.
5. The subject of this essay is, aimed at the discussion of how C2 capabilities may effect the tangible war fighting capabilities, i.e. maneuver and firepower elements.

II. DEFINITIONS

1. Command and Control: The exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of his mission. Command and Control functions 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 and operation in the accomplishment of his mission.²
2. Command and Control System: The facilities, equipment, communications, procedures, and personnel essential to a commander for planning, directing, and controlling operations of assigned forces pursuant to the mission assigned.
3. Force Multiplier: It can be defined as increasing the combat effectiveness of a given tactical ground force by employing a technique or a force other than a ground maneuver unit.³

4. Command, Control, Communication Countermeasure (C3CM): The integrated use of operations security, military deception, jamming and physical destruction, supported by intelligence, to deny information to, influence, degrade, or destroy adversary C3 capabilities and to protect friendly C3 against such actions. The techniques involved in C3CM run from use of lethal weapons, to military deception, to highly sophisticated electronic countermeasures.⁴

III. DISCUSSION ON C2 SYSTEM

1. General:

a. Several terms for the definition of C2 have been used so far, because C2 "cuts swath right across the fiefdoms of powerful functional entities--from intelligence to operations to computers to communications."⁵ "The most used form is Command, Control and Communications (C3). Sometimes C3 is used in connection with intelligence and has become known as C3I. Other times, C3 is raised to the 4th power (C4) to represent computers."⁶ It is not the purpose of this essay to discuss the terminology. However, I prefer to define it as Command and Control (or C2) during my discussion for the sake of simplicity and for the conformity with JCS Pub-1. I will use the other forms only within the excerpts from other authors.

b. As it is very clear within the definition (Section-II), C2 is required for all assigned forces without any exception, and it contains planning, directing, coordinating, and controlling the activities of these forces, as well. For that reason a C2 system is an integrated system of different functional areas (i.e. personnel, intelligence, operations, logistics etc.) and for the activities of different types of forces (i.e. combat, combat support and combat service support).

c. A C2 system is a supporting function for the commander and it simply means,

acquisition of requisite data (intelligence); delivery in a timely fashion (communications); storage, processing, retrieval and display (computers); in such a manner as to permit the commander to positively influence the outcome of events.

The vital actions of the commander and the staff are performed through the system which include; to receive and analyze mission directives, to gain and analyze information, to estimate, plan and make decisions, to prepare for operations, and to monitor, control and coordinate operations.

d. A C2 system has its unique goals. The most important are "enduring and survivable command and control facilities and associated communications links; rapid and accurate intelligence dissemination to all appropriate levels of command."⁸ The overall system is designed to provide interoperability with the other friendly systems, security, flexibility, survivability. Electronic warfare and counter C3 capability establish an indispensable goal.

e. Naturally, a system in this volume has several subordinate systems in tactical level according to the activities and staff functional areas. The most advanced C2 systems will probably include the following subordinate systems at all applicable levels: Maneuver (or operations), Intelligence/Electronic Warfare, Fire Support, Air Defense and Combat Service Support (including personnel and logistics). If we remember the definition again, we can easily assume that all these subordinate systems have personnel, equipment, communications, facilities and procedures as the individual elements of the overall system. We will return to these elements and describe each briefly.

f. As an integrated system of different functional areas, C2 system helps the commander "to learn what is going on, to decide what to do about

it, to issue the necessary orders, and to keep track of how the battle is going."⁹ It also allows him to be keeping abreast of the specific operations and the overall situation.

g. It is very clear that C2 is a rapidly growing area that requires a vast investment. It is also "a blend of technologies and disciplines ranging from electronics and computers to exotic sensors, display, techniques and common sense."¹⁰

2. Personnel:

a. The human being is the most important element in the system. In fact,

the central feature of any C3I system is the human decision maker--the commanders plus their various staffs and others. These decision makers operate within a framework of established doctrine, strategies, tactics and procedures, communication links, command facilities and other equipment.¹¹

b. For a survivable C2 system, duplication of facilities and communication links are extremely important. Therefore, the efficient amount of personnel, together with necessary equipment, is assigned to operate the system including its duplication on a 24 hour basis.

3. Procedures:

a. Procedural aspects of C2 may cover anything which regulates the functions of the different elements of the system. They create a smooth environment for the elements of the system and for the subordinate systems to function together. Thus, the commander makes his greatest contribution to the system by establishing C2 procedures for his command.

b. Probably, the most important procedures are the staff action procedures.

(1) Since the human factor is the central feature of the system and the system is designed for the human decision makers, it is logical and

easy to begin with the activities of the personnel and regulate the process. This is a dynamic process. It's primary measure of effectiveness is whether it functions efficiently and more quickly than the enemy's. Since the commander is the focal point in the system, he is the number one user as well as participant.

(2) That process establishes a cycle "which is a very good model for the command and control process-oriented on goals and focused on the commander."¹² If all the other factors are equal between two adversaries, the C2 process will be the key to winning. If we are able

to cycle continuously through the process more quickly than the enemy, presenting him over and over with new threatening situations in the middle of his command and control cycle,¹³

we will force him constantly to turn back to his assessment phase. "The desired effect on the enemy commander will be confusion, psychological dislocation and, most importantly, loss of initiative."¹⁴

c. The other C2 procedure which is almost as important as the procedures for the function of staff is for the provision, transmission, processing and exchange of information. We can say that if the commander and his staff is the brain, then the information for the system is the blood which feeds the brain and all other organs. This aspect of C2 procedures is closely interrelated with the communications, intelligence, command posts and information process elements of the overall C2 system. Therefore, it is assumed to be included within those related elements together with some standing operating procedures, such as reporting, communications, command posts, etc.

d. Other procedures can be developed on air-ground cooperation, succession of command, and alert systems. All these activities may be planned, coordinated, directed and controlled by the system itself.

4. Communications:

a. If we continue to describe the C2 system as a human body, we have to admit that the communications element has the role of the veins. Therefore, reliable and survivable communications is very important factor for an effective C2 system.

b. Since the goal of a communications system is to enhance the operations (both tactical and administrative), all the restricting and limiting factors against the operations must be eliminated during the development phase and lifetime of any communications system.

c. The communications element fulfills its important role by providing vital links between command posts, between the C2 subordinate systems, and between the highest tactical and operational level, and by tying the command it serves to the other services and allies so required. These vital links are not only conventional HF radios, telephone lines, CW etc., but also high quality data links between computers, satellite communications, radio links, and facsimile communications which allow the exchange of graphic and symbolic information as well.

5. Intelligence:

a. "Intelligence provides the basis for tactical and operational decisions."¹⁵ In order to be successful against his counterpart, the commander must know not only his troops and their capabilities, but he must also know the terrain, the weather, and, most importantly, the enemy and its strengths and weaknesses.

b. In the modern C2 context, the intelligence aspect is closely interrelated with the procedures (i.e. the establishment of intelligence circle etc.) and the information system which sorts, stores, automatically issues, and validates intelligence information. In summary, "intelligence activities are the organized efforts of a commander to gather information

on terrain, weather and the enemy."¹⁶ On the other hand, within the intelligence activities, target development establishes the vital source of correlated information on the enemy targets on which commander can direct his scarce and expensive weapon systems in a timely and effective manner.

c. Intelligence not only supports C2 activities, but also establishes the vital information to disrupt or destroy the enemy C2 capabilities. We can easily come to the decision that "C3 and C3CM support can not be effective unless they receive aggressive intelligence support."¹⁷

6. Command Facilities: (Command Posts/Command Centers)

a. Command facilities provide an environment in which the "brain" function safely and continuously with the necessary equipment. If we want to win the battle by exercising positive command and control, we must always have a command facility to exercise command and control during the battle.

b. Having a command facility does not necessarily mean being in the same place or being in the same facility. However, because of the rapid development of sensor technology and weapons capabilities (both conventional and nuclear) there have been several changes in the concept for the survivability of command facilities. These changes necessitated the adoption of modularity, dispersion, hardening, EMP protection, frequent movement, and succession of command.

c. Each of the above concepts have their unique advantages or disadvantages. For example; if we go to an excessive modularity or dispersion, we increase our survivability to an important degree. But, on the other hand, communications, data processing, security, and administrative support will be very difficult matters, and probably personal coordination between staff officers will be effected negatively. Although hardening promises better protection and thus survivability, it seems inappropriate for the

tactical level commands because of the very fluid nature of the combat situation. On the contrary, mobile command facilities and their alternates with administrative support from fixed installations are more suitable for the tactical level commands. Within this context, tactical command post "is strictly a command and control facility, and it exists primarily to give the main command post a capability for frequent displacement."¹⁸

d. The latest improvement to the concept of command facilities is the EMP protection which increases the survivability of the electronic equipment in case of a high altitude nuclear detonation. In a nuclear environment, we will not be able to enjoy the benefits of high electronics technology (both communications and computers) if we have neglected EMP protection.

e. As for the mobility, "the basic idea is to move the command post before the enemy has time to detect, identify, accurately locate, target and deliver fires against it."¹⁹

f. Naturally there are other ways, means and factors which effect the efficiency of command facilities. They may vary from "the individual and collective training and experience of its members" to "numerous other human factors such as stress, fatigue and unit cohesion."²⁰

7. Data Processing:

a. I intentionally did not use the term "automation" as the title, and rather preferred "data processing". My purpose is to neither reject the very important role of computers in the overall system nor over emphasize it. In fact, within this portion of my essay, I will focus on automation since the manual data processing is something that human beings have been fighting with for centuries. However, a manual system still maintains its importance as the ultimate back-up system of its modern successor.

b. Automation does not represent the total C2 system. However, the application of automation to the tactical area has created unlimited horizons for a sophisticated C2 system as a whole. Therefore, we are in a position to pursue that high technology and we should do this to the maximum extent possible if we want to handle the C2 cycle shorter and quicker than the potential enemy does.

c. The computers have become an indispensable element of military activities and thus of C2 system. Their performances are well beyond the conventional manual means in the areas of data analysis, display, weapon control, navigation, communications, target acquisition and many others. Computer technology is developing so rapidly that it promises to solve any kind of problem in an unbelievable period of time.

A survey conducted by HQ DARCOM in the fall of 1981 indicated that there were 131 Army battlefield systems, some deployed, some undergoing development,²¹ in which the computer was an essential and integral element.

d. The high performance and capabilities of the computer must not mean that the user may demand unrestricted information. The volume of requested information is not only related with the computers, but also with the communications systems and, to some extent, with the humans who establish the sources of information at the lower levels. Therefore, "the first order of business is for the commander to set out the elements of information he needs to run the battle."²²

e. One of the important factors which restricts us in the development of computer support to our C2 system is the human foibles. "Yet, for some processes, it is smarter to use a human being than a computer."²³

8. Countering the Enemy's C2 System:

a. Since our strategy is to be as forward as possible in the C2 cycle compared with where the enemy is, we have to develop our capabilities to

disrupt or destroy the enemy's C2 system as well as to protect ours. Counter Command, Control and Communications (Counter C3) or Command, Control and Communications CounterMeasures (C3CM) have been given the necessary attention and concern very recently. Accordingly the commanders were given the necessary tools to achieve the goals of above statement. Therefore,

developing and enhancing technology for both C3 protection and C3 countermeasures are likewise vital considerations if we are to fight and survive in the hostile C3CM environment of the future. We must provide the tools and techniques required to operate a command and control system under stress.²⁴

The necessary technology has been developing to increase the survivability of our system, and to better counter the enemy's capabilities.

b. It is equally important to formulate a concept for C3CM together with material development. A C3CM concept which has been produced recently is "a technique by which a commander can employ all available means to degrade, disrupt or destroy the enemy C3 structure."²⁵

9. Force Multiplier:

a. As shortly discussed in Section-I, there is no possibility for NATO allies to reach a quantitative conventional balance with the WP in the foreseeable future. NATO has the option to achieve and maintain the superiority in terms of quality.

b. Once the conventional forces have been provided with better personnel, systems, equipment, supplies and with timely and correct command decisions, then the quantitative values will not be the final factors in the assessment of relative combat powers of the opponent sides.

c. Thus, in order to reach an "enhanced combat effectiveness in the face of a numerically superior enemy, several so-called force multipliers were identified."²⁶ A force multiplier can be a new concept and doctrine, or a new equipment and vehicle, or a system such as command and control.

"This enhanced combat power generated by a force multiplier will enable us to win if applied at the right time and in the right place."²⁷

IV. POTENTIAL OF C2 AS A FORCE MULTIPLIER

1. Historical Examples:

a. History shows us there have been battles in which smaller forces have beaten the larger ones. If the information related to those battles is reviewed and assessed carefully, the findings will reveal that there is always something new with the victorious side. It could be a new doctrine, a new technology, surprise, a new organization, or leadership. It would be helpful for us to better understand the role of a command and control system to recall some recent historical examples.

b.

In May 1940, when the Germans attacked against Holland, Belgium, Luxembourg, England and France, the combat power on both sides was about equal. But in communications the Germans had the edge: they capitalized on radio links among ground formations and between ground and air forces. The allies clung mostly to the telephone as the basic means of communication, supplemented by motor messengers. . . . The combination of new communications technology integrated into new organizations and timely air-ground coordination multiplied the effectiveness of the German forces considerably.²⁸

c.

The battle of Britain (September-November 1940) is another example where a smaller force has beaten a large one. The resources available at the start of the battle: Britain 650 aircraft, Germany 2120 aircraft.²⁹ Adequate and timely intelligence, coupled with near real time communications and survivable command centers, enabled the RAF commanders to place limited but extremely effective firepower at the proper place and at the correct time to defeat an otherwise superior force. The Air Battle of Britain is one of the more dramatic and explicit demonstrations of the effective exploitation of the technology of surveillance and communications in the agonizing process of decision.³⁰

2. A Current Example:

a. The explanation of a C2 system as a force multiplier becomes very clear if the outcome is tangible. Therefore, in order to deal with some

figures, my example of a current C2 system is the Short-Range Air Defense (SHORAD) C2 system, which is about to complete its development phase.

b. The SHORAD C2 system establishes a classical example. It is composed of displays, processors, communication links, and sensors as the major elements. The system provides the gunner with a real time air defense picture, including target information over his area of influence.

c. By using automation and

with alerting and cueing . . . a stinger gunner can complete the engagement process, launch his missile and intercept the target at approximately five to six kilometers from his position. If this same gunner under the same conditions is not alerted and cued, he will probably start the engagement process (detection) at approximately two kilometers. . . . Without C2, the probability is high that the gunner may not be able to engage a Threat aircraft until it has overflowed him. Also, if the Threat aircraft is offset from the gunner and never comes closer than two kilometers, the gunner will probably never detect it unless alerted. Therefore SHORAD C2 represents a tangible element of combat power against the Threat.³¹

3. Role of C2 System in the overall combat effectiveness:

a. In evaluating the role of a C2 system as a force multiplier, we have to keep in mind that "combat power is relative, never an absolute, and has meaning only as it compares to that of enemy,"³² and that a, command and control capability itself is very difficult to quantify. Therefore, we can not develop any mathematical formula in order to create a "C2 coefficient" to deal with the tangible elements of combat power.

b. The known combat power elements are static if they are not used. What makes them dynamic is the human desire, assessment, decision, and finally execution. Therefore, in order to transfer a static power into a dynamic one, certain human actions are necessary. These actions naturally influence the combat power during their transition from static to dynamic. These actions were briefly discussed and named as "C2 Cycle" in Section III.

c. In order to activate any unit (maneuver or support) or any weapon system, we have to start the C2 Cycle. Let us think now what happens if our cycle does not function properly. There are two dangers in such a case:

(1) The system may become unsuitable for the exchange of timely (near real time, sometimes real time) information and orders between the decision makers and executer, i.e. the unit commanders or the gunners in the case of weapon systems. The outcome of such a situation is disorder and confusion for the units, and very low kill probability for the weapon systems since almost all of the targets in the future battlefield will be extremely mobile. As it was discussed earlier, using a C2 system for the SHORAD system, the gunners will have a 3 to 4 kilometer advantage at the worst case which would provide at least 16 seconds more reaction time than a gunner without the system will have. In such a battle situation, there is also a possibility that the gunner without the system may fire against a friendly close air support or interdiction aircraft because of a very short detection range, lack of IFF equipment, and lack of target information.

(2) The human beings within the system may not have sufficient experience and knowledge because of lack of training. In such a case, a C2 cycle will be degraded and will not function more quickly than the enemy's. That situation will also result in very similar outcomes as outlined in the first case.

d. One may argue that we have subordinates with sufficient initiative, and they can continue the operations successfully. That may be so, but on the other hand, if the system does not function continuously and properly, then the higher echelons lose their ability to influence the situation. In such cases one of the very important principle of war--unity of command--together with unity of effort will not be achieved. Lack of

the C2 system or any malfunction thereto will also result in undesired outcomes of combined arms, joint and combined type of operations.

e. From the beginning to the end, any crisis in a politico-military sense or a war contains a series of actions and reactions. If our C2 cycle functions slower than the enemy's, then it means that the enemy is acting and we are reacting. In short, it means that we have lost the initiative. In that case, we would be unsuccessful in the achievement of one of the very important basic tenets of Air Land Battle doctrine--initiative. Initiative necessitates us to "make decisions and act more quickly than the enemy to disorganize his forces and to keep him off balance."³³ To create such an advantageous combat situation has always been a dream of the commander. Therefore, "proper execution of command and control responsibilities is vital to a unit's success on the battlefield."³⁴

f. Up to the present time, the weapon systems have been enjoying the high technology to the maximum extent possible. Their range, speed, accuracy, and lethality have increased dramatically. On the other hand, sensor systems have been introduced recently, and their capability to provide the decision makers with timely and precise information is increasing steadily. As we think about the target and weapon system relationships of the future battlefield, we will have to accept that neither conventional communications means (for the exchange of such a huge volume of target information and fire orders) nor human ability (to process--sort, update, validate--those information, to achieve rapid target analysis, to allocate the targets timely enough to the weapon systems, and then prepare and send the fire orders to the suitable weapons) promises success if they are not developed and/or supported by other means. Thus, a technologically developed C2 system is a prerequisite also for the future target weapon processes. We have no other choice. In this context, we have to think about all the

services developing capabilities on sensors. Therefore, the subjects like target information exchange and allocation of weapon systems must be expected to be more complicated, and a matter of inter-services, even inter-allied forces. If we can not achieve such a goal, we must not be optimistic about making full use of the effects of our future fire support. Such a situation will deeply affect not only the effectiveness of fire support units, but also the combat effectiveness of maneuver forces. That discussion ultimately leads us to the conclusion that C2 and weapon systems establish an integral nature.

g. One of the very important roles of the C2 system is the facilitation of rapid staff coordination as well as providing for the different functional staffs--single service, joint or combined. Thus, each functional area informs in real time basis the others what is happening in its area of responsibility. As a result of this coordination, a C2 system automatically increases the teamwork and cooperation among the services if so designed.

h. No other statement can explain the role of command and control better than the following one related to the Air Land Battle concept: "No element of that concept is more essential to the development of a credible war-fighting capability than command and control."³⁵

V. RESEARCH FOR A BETTER C2

1. General: This section is intended to discuss the threat against C2 system, and C2 deficiencies. It will also provide recommendations for a better C2 system in order to gain increased combat power.

2. Threat against C2 System:

a. On the battlefield, the ultimate goal of any commander is to reduce the combat effectiveness of his opponent, and thus to destroy his will to fight. In a tactical area, the C2 capabilities of NATO have always been the highest priority targets as far as WP doctrines are concerned. Therefore, we must expect a wide range of threats against our C2 system.

b. "The thrust of Soviet planning and training is to deny the United States and its allies use of the electromagnetic spectrum."³⁶ Therefore, our communication systems and computers will face a wide variety of threat (i.e. electronic countermeasures, effects of the EMP and physical attacks by conventional or unconventional means.)

c. The enemy's capabilities in detection and identification of friendly C2 facilities have been dramatically developing together with the range, accuracy and lethality of its weapon systems. At the operational and tactical level, C2 facilities (to include both command posts/command centers and communications centers) must be assumed as being continuously monitored and included in the top of target analysis, and also as being targeted by the most sophisticated weapon systems.

d. Command facilities are also vulnerable against insurgency and guerilla type operations. These kind of threats are also taken into consideration during the operations and/or movement of mobile facilities.

2. Current C2 deficiencies:

a. Since the C2 system covers very different kinds of elements, its deficiencies are also very different in nature. However, the general deficiencies may be summarized in terms of survivability, standardization, requirement definition, organizational, managerial, and procedural.

b. The tactical C2 system is vulnerable against ECM, EMP and physical attacks as well. There is no way to hide the C2 facilities from the enemy

since the communication facilities emit electromagnetic waves. Moreover, they all have a great amount of vehicles and personnel which cause a heavy traffic.

c. Standardization has not been given the necessary attention for a long time. The result is inferior, nonstandard electronic equipment not only among the services or allies, but also within the Army itself for example

the rapid growth in the use of go-to-war computers over the last six years has resulted in an extensive proliferation of different and incompatible types. In 1979 an initial survey indicated there were 35 different types of computers employed in 49 Army battlefield automated systems. A wider survey in 1981 indicated 50 computer types in 65 systems.³⁷

d. The formulation of C2 requirements has long been a major problem. In many functional areas, the information requirements have recently been completed. However, in the combat service support area, the "key information elements are not published as doctrine; therefore, these elements vary among divisions and corps."³⁸ It is strange enough that, although combat service support (i.e. mainly personnel and logistics) is one of the best suitable staff functional areas for automation, the fact remains that little has been done to automate it. As a result, "whatever information is gathered must be analyzed manually by the combat service support staff. This allows no capability to provide real time information to the force commander."³⁹

e. The requirement validation together with the definition is still a major problem, as well. The reason is that the general staff and other users frequently fail to properly articulate their real operational requirements. One of the very important aspects of operational requirements is information needs. Because the users are unsuccessful in identifying their minimum essential information requirements,

there is currently too much information, and it is hard to tell which information is relevant, and even harder to establish criteria for filtering information.⁴⁰

This results in a very dangerous situation; the commander is provided outdated information rather than near real or real time information by his staff.

f. The overall illness concerning the system requirements definition can be summarized as follows:

The problems start when the technicians try to design equipment to fit our C2 needs. They have no common basis for deciding what those needs are, and their solutions sometimes solve the wrong problems.⁴¹

g. Organizational deficiencies may be summarized within two main groups.

(1) First; there is a tendency within the different staff divisions to maintain their identities. That prevents the idealistic coordination and cooperation among them. The situation in the battlefield is still like that: "The G3/S3 and G2/S2 vans get separated, their occupants do not talk to one another."⁴²

(2) Second; the C2 organization, in most cases, is inadequate. That deficiency affects both the quality and quantity of the organizations, the way they function, and the personnel within these organizations.

h. Centralized management for C2 systems has also been neglected for a long time. It is still a reality that the lack of efficient central management causes many problems, such as interface and interoperability. Without central management "things could still be put together theoretically; but, we don't have a single manager responsible to decide on the trade-offs."⁴³

i. The reporting system is an example of one with a procedural deficiencies. The reporting system itself is very important. It has a

vital role in the system to carry the necessary information to the decision makers. The operational reporting system is based on a sequential reporting, i.e. from companies to battalions, to brigades and so on. However, this requested reporting causes the problems. "Every time information passes through one of those sequential reporting nodes, two things happen: It gets slowed down and it gets mixed up."⁴⁴

3. Recommendations for a better C2 System:

a. General:

(1) Everybody involved in C2 system must continuously try to find ways to upgrade it.

(2) C2 systems must be simple and also be easy to set up and tear down.

(3) Since the modern battlefield necessitates initiative in subordinate commanders, the C2 system must be designed and constructed accordingly.

(4) C2 system must include all functional staff areas.

(5) C2 system must include the activities to counter the enemy's C2 capabilities.

b. Survivability:

(1) C2 system must have the capability to function in any electronic warfare environment and must have EMP protection.

(2) Command posts must have the capabilities of frequent deployment/redeployment, deception, duplication, and they must be small in size.

(3) The system, itself, must have logistical and personnel supportability.

c. Standardization/Interoperability:

(1) Management organizations must be consolidated to achieve standardization/interoperability as well as management effectiveness.

(2) All the C2 systems in the Army must be standardized.

(3) All the C2 systems must have interoperability with the systems of the other services and allies.

(4) Standardization in computer language, software and in the hardware acquisition system must be the ultimate goal not only among the services of one nation, but also among the allies to eliminate the problems of interoperability/compatibility etc.

d. Requirement definition:

(1) The commanders at all levels must state their information requirements, and continue to update what they have at any time.

(2) Key personnel from general staff (i.e. G1, 2 etc.) must be trained to the extent possible to be able to better formulate and articulate their tactical (operational) requirements.

(3) The roles of the tacticians and technicians in the requirements analysis phase must be clearly and logically defined.

e. Organizational:

In light of the rapid technological advances, the organizations of classical general staff and special staff must be continuously evaluated and changed if necessary.

f. Procedural:

(1) Standard C2 procedures must be established.

(2) Joint concepts, tactics, and techniques must be developed regarding the C2 systems.

(3) The flow of information must be increased by means of continuous arrangements in the reporting system and in the communications centers' standard operating procedures.

(4) More frequent joint and combined exercises and efficient single service and joint training must be achieved.

(5) Decision making process in the operational and tactical levels must gain the necessary momentum by means of continuous revision of the conventional staff action procedures.

(6) The destruction of the enemy's command and control capabilities must be the top priority goal in the minds of the commanders at all levels.

VI. CONCLUSION

1. A command and control concept is as old as any military concept. It has become so popular in the last decade because of the unrestricted application potential of high technology to the C2 system. The developments so far are just the beginning in that field. Even taking into considerations these rather primitive developments, we can say that the relative efficiency and superiority of C2 systems will be a key element in determining the winning side.
2. It must be expected that electronics, with their almost daily improving nature, will still have many things to contribute to our C2 systems. However, there is still a serious problem; tacticians (i.e. the users of the system) lack the sufficient level technological knowledge. That serious problem must be overcome rapidly and the tacticians must learn how to live and work with high technology and how to control it. However, if the commanders do not take more active and more positive roles in the system (beginning from the requirements definition step of development phase to the end of the system's life) we must not expect too much from the C2 systems at the tactical level.
3. Finally, we must accept the following statement as a guiding maxim:
"Without effective command and control, we can never hope to fight successfully and win the Air Land Battle."⁴⁵

ENDNOTES

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ABBREVIATIONS

C2: Command and Control
C3: Command, Control and Communications
C3I: Command, Control, Communications and Intelligence
C3CM: Command, Control, Communications Countermeasures
ECM: Electronic Countermeasures
EMP: Electro Magnetic Pulse
IFF: Identification of Friend or Foe
RAF: Royal Air Force (of The United Kingdom)
SHORAD: Short-Range Air Defense
WP: Warsaw Pact