Impact of Information and Precision-strike Technologies on Future Warfare

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EXECUTIVE SUMMARY

Title: Impact of information and precision strike technologies on future warfare

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Thesis: This paper argues that future war is best served by decentralized organizations and command structures despite the obvious inclination to centralize offered by the fast developing information and precision strike technologies.

Discussion: For several reasons, there is a tendency to utilize developing precision strike and information technologies in centralized organizations with centralized command and control. This is a tendency pointing in another direction than current doctrine for most Western armed forces that preach some kind of maneuver warfare. This raises the question of whether the centralization tendencies, with a subsequent shift in doctrine offered by the new technologies is the best way to go, or if current doctrine is basically sound and only needs adjustments to accommodate the developments?

The paper is divided into three parts. It first gives a short description of a possible future decentralized structure built around the three theoretical levels of war. The upper two levels are HQs while the warfighters are a number of taskforces, joint or functional, at the tactical level. The number of intermediate levels is greatly reduced.

In part two it creates a basic platform for the later discussions. It first gives a short general discussion on the characteristics of centralized and decentralized structures. It then describes the major characteristics of the evolving information and precision strike technologies. It points out possible future capabilities that might be provided.

Based on this basic platform, part three will discuss how decentralized versus centralized structures fits into future war and how best to utilize the characteristics of the emerging capabilities. The discussions covers trends in C2 and organization, likely future challenges, who is best situated to make the right and timely decision, and if command at a distance as briefly presented by Gen Franks justifies skipping or drastically change the roles of the three basic levels of war.

Conclusion: Future war is best served by a decentralized organizations and command structures. Based on the three levels of war, -strategic -operational and -tactical, fast-developing information technology should be utilized to enhance each levels abilities to effectively execute command and control and to reduce intermediate levels. Further, the precision strike capabilities should focus on enhancing the operational level's ability to shape operations and increase the tactical levels agility and combat power. This decentralized structure will best be able to meet the wide range of possible future challenges and to rapidly adjust to fast changing situations. Further, it will offer the most robust and less predictable structure. By focusing on tactical task forces as war fighters the inherently best situated level's ability to employ combat power in accordance with rapidly changing and complex environments will be optimized.

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A. Introduction

A recent Washington Post article on Afghanistan under the title "A War That's Commanded At a Distance" again raises the discussion on decentralized versus centralized command and control. The article portrays the differing views on the matter between Gen. Tommy Franks (Current CINC CENT) and some of his critics. On a theme of utilization of modern information and precision-strike technologies, the article suggests that "Franks long range command could be a model for future war".[1]

For several reasons, there is a tendency to utilize developing precision strike and information technologies in centralized organizations with centralized command and control. This tendency points in direction diverging from the current doctrines of most Western armed forces that preach some form of maneuver warfare. This raises the question of whether a tendency toward centralization with a subsequent shift in doctrine offered by the new technologies is the best way to go, or if current doctrine is basically sound and only needs adjustments to accommodate new developments? This paper argues that *future war is best served by decentralized organizations and command structures despite the obvious inclination to centralize offered by the fast developing information and precision strike technologies*.

The paper will be divided into three parts. First it will give a short description of how a possible future decentralized structure might look. In part two it creates a basic platform for later discussions covering the characteristics of centralized and decentralized structures as well as future technologies. Based on this basic platform, part three will discuss how decentralized versus centralized structures fit into future war and how best to utilize the characteristics of the emerging capabilities associated with information and precision strike technologies.

B. A future decentralized structure

1. As a basis for subsequent discussions, this is how a future decentralized system could look. As the intent is not to come up with a new and complete military structure, the characteristics are shown in general terms. For the purpose of contrast, the present structure in principle is given in fig 2 and the future structure in fig 1.

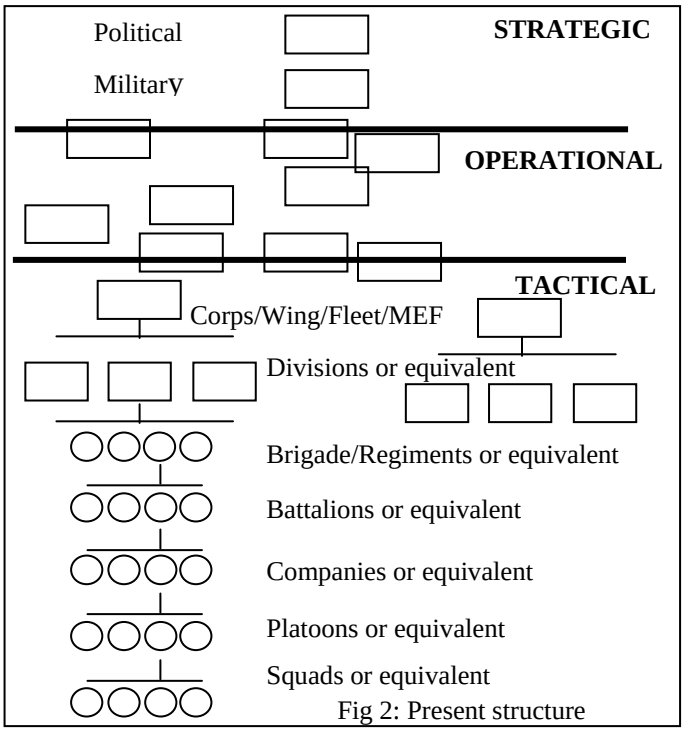

Fig 2: Present structure

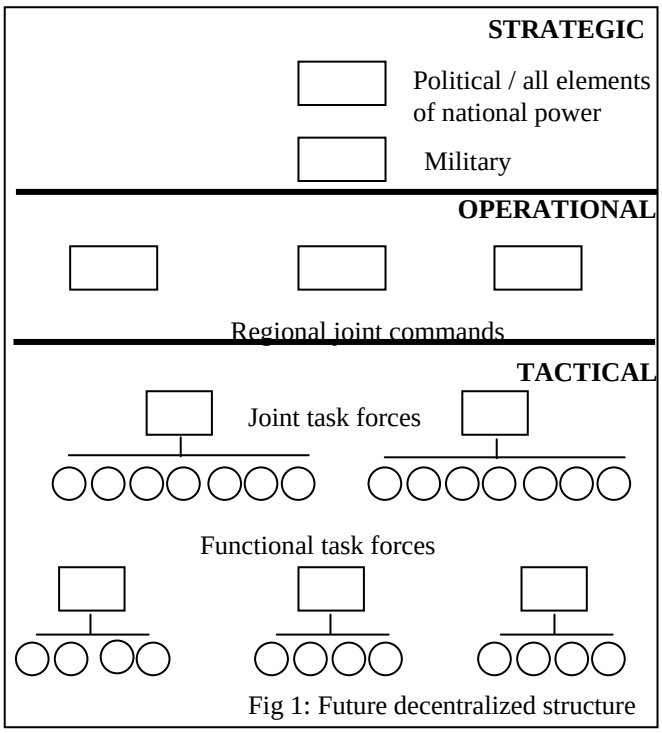

Fig 1: Future decentralized structure

2. The future decentralized structure should still be built around the three theoretical levels of war; strategic, operational, and tactical. The new technologies should enhance and reduce the number of intermediate levels of command within each level of war. The upper two levels should constitute a HQ structure while the tactical level constitutes the force structure. In this model the warfighters are a number of task forces, joint or functional, at the tactical level. Depending on the mission, Functional task forces will support higher levels with strategic and operational tasks, support the Joint task forces, or in some cases execute strategic and operational missions. To decide the right number of HQs, task forces and their composition, more detailed studies are required and lie outside the scope of this paper.

3. The advantage of maintaining an overall decentralized structure is that it provides the most flexible structure best able to adapt to changes and the broad range of possible future challenges. It also provides the most robust and least vulnerable structure. By maintaining a decentralized structure while simultaneously leveraging the benefits of centralization in organization and C2 offered by the new and evolving technologies, more recourses can be shifted from HQ and support functions to actual combat power. After establishing a basic platform, the subsequent discussion will provide the reasoning why this is the best way to go.

C. Characteristics of centralized and decentralized structures and future technologies

1. This part of the paper is divided in two and will provide the basis for the main discussions in Chapter D.

2. Characteristics of centralized versus decentralized organizations and command structures.

a. Command and organization structures are closely linked and there are many ways of describing them. This part of the paper will discuss the characteristics of centralized versus decentralized military structures.

b. In a centralized organization there are few decision-making levels. In extreme cases there may be only one. Unity of effort is achieved by rigid command and control with detailed and explicit orders. This organization allows little room for freedom of action and initiative at the lower levels. Thus, centralized control of higher level resources, i.e. corps artillery, is normally retained at higher levels and seldom delegated.

In order to support the decision maker, lower levels execute extensive and detailed reporting. The mainstream of information goes upward while orders go downward. The optimal span of control for a decision-making level is traditionally considered to be between 3 to 7.[2] The more detailed the command and control the fewer subordinate entities can be controlled. Consequently centralized organizations tend to be multilayered in a hierarchal model. As a result both of the detailed requirements and the number of intermediate levels

the information flow is traditionally considered time consuming. Detailed decisions therefore tend to be made on relatively outdated information. The organization is further vulnerable to interruptions in the information flow. In such cases decisions are either delayed or made on assumptions.

Because of the above-discussed factors, centralized models tend to be less flexible and adaptable to rapid change. The centralized model counters these effects through massing of resources and maintaining focus of effort, but it still tends to work best in more stable and predictable situations.

c. Multiple decision-making levels characterize decentralized structures. Command and control are spread on many levels. Unity of effort is achieved through intentions and general directives. The general belief is that the level actually engaged in an action has the best and most updated situational awareness. Consequently it is best situated to make the right and most speedy decisions.

Information flow in these structures tends to go both ways and is more general in nature. Independent judgment and low-level initiatives are desired. Consequently there is a tendency to delegate resources to lower levels for optimal utilization. Higher levels concentrate on maintaining the overall picture and facilitate subsequent actions. With less demanding and detailed command and control, decentralized structures enjoy a higher span of control. Decentralized organizations however, are especially demanding on leaders at all levels. Initiative at the lowest-levels maintains an inherent risk that not all resources are optimally utilized, not all initiatives will pay off. The organization optimizes its ability to function in rapidly changing and unclear environments, and consequently tends to be more flexible and adaptable to change.

3. Future capabilities provided by information and precision-strike technologies and trends in C2 and organization.

a. As the second part of the basic platform we need to establish what future relevant technologies can provide. The dominant future technology seems to be within computers and programming. The ability to store, organize and process information continues to evolve at close to revolutionary speed. Over the least decade the number of computer computations has increased by a factor of ten every five years, while the memory storage capacity has doubled every eighteen months.[3] Concurrently, the costs of computing as well as size of computers are rapidly declining.[4] There seems to be no immediate indication of slackening in these trends.

The basis of computer and programming technology opens a window of opportunities into other fields. Coupled with other technologies such as communications, sensors, or munitions, a multitude of information networks or systems can be created. The networks or systems can be created both at the macro and micro levels.

Within communications there are several rapidly evolving trends. Aided by electronic miniaturization technology, equipment can be made increasingly smaller, more powerful, and sustainable. With digitalization and data compression techniques, satellites, laser communication and fiber-optic cables, the amount and speed of information that can be transmitted increases rapidly. This development promises the ability to bind systems or networks together at a scale heretofore only imagined. A limiting factor in wireless communication is still the available bandwidth, and no immediate solutions appear available. This means that although speed and the amount of transmission increases there are clear limitations, i.e. the amount of video imagery that can be transmitted.

Sensors can be divided in two main groups, those that provide information on friendly equipment/systems and those that provide information on the enemy. In the future, sensors that enhance internal situational awareness, including IFF (identify friend or foe) sensors, will be incorporated into all kinds of equipment and systems. Information will automatically

be reported, processed and disseminated into a multilevel information network.

Sensors that help provide information on the enemy, however, are not as promising. These will be challenged by enemy countermeasures and, within some fields, there are still technological hurdles that must be overcome. We can, however, expect increasingly more accurate systems that will enhance situational awareness and target acquisition. This is especially true with regard to large-scale, high intensity conflicts involving large formations and heavy equipment. The greatest challenges will be in providing accurate information in asymmetrical conflicts in water, urban, and high foliage environments.

The greatest development anticipated regarding munitions would probably be the integration of munitions with other technologies. The result will be greater numbers of autonomous and homing munitions with a substantial increase in accuracy. Technology will allow such systems to be integrated into ever-smaller munitions. In addition to increased accuracy, the costs of such systems can be expected to decrease substantially. From normally being on the shortfall list, in the future precision-guided munitions will be the norm. Although substantial developments in power, speed, and range of munitions cannot be ruled out, these are not likely to happen in the near future.[5]

b. What kind of future capabilities will be available?

The purpose here is not to guess what the state of art might be in the future. Rather it is to describe what future structures might be built from. Today's emerging capabilities might be dominant in 2025. When an information network couples all of these systems we get the so-called "system of systems".[6] In today's state of the art of military equipment/systems we only see the contours of what will be available in the future.

Multilevel Information networks will be available with the capacity to exchange huge amounts of information. The reach of the networks will greatly expand and will, in the future, extend down to the lowest levels. Exploited correctly, multilevel information

networks will be a major factor in increasing operational tempo, providing a marked advantage in maintaining initiative.

A variety of different sensor systems will be available. These sensors will be coupled to the information network and will greatly enhance situational awareness. This will especially be applicable with regard to friendly forces and timely target acquisition.

We will also see a substantial increase and development of reconnaissance-strike systems. These systems couple sensors, weapons, and platforms into integrated systems. The current war against terrorism gives good indications on what capabilities we can expect in the future. Reconnaissance-strike systems like the *Predator*, with integrated sensor and weapon system, have been employed successfully. The C2 of such systems are still centralized. In the future we might see autonomous systems.

Precision strike engagement systems, or what is generally termed stand off fires in the emerging Network Centric Warfare concept, will be fully integrated into the structure and available at all levels. [7] At the tactical level we can expect autonomous and self-homing munitions to be fully integrated into the main structures of the armed forces.

D. Centralization versus decentralization in future war.

1. What are the prevailing trends on command and control and future organization of new capabilities? When technology promises close to real time information that can be shared across a magnitude of levels, it has a tendency to centralize command and control. There is a saying that any commander will act on the information he has. If a higher commander has the same information available as the lower level, he doesn't need that level to make the decisions for him. The United States Air Force, with its current concept of effects based operations is maybe the best example of this tendency. War is narrowed down to a question of targets. All potential targets are analyzed, prioritized, and attacked based upon a centralized master plan. Execution is relatively inflexible and evolves around preset cycles that do not adapt well to rapidly changing

situations and integration with other forces. When planning is so centralized and detailed only lower level tactics/techniques and administration tends to be left to the executors. The big question is, of course, how “real” the close-to-real-time information really is? This question will be discussed in more detail in paragraph 3.

The evolving information networks will broaden earlier assumptions of the number of subordinate elements that can effectively be commanded and controlled. The old belief was that the optimal span of control was between 3-7. How far the control span can be extended is not clear. There are still limits to the number of elements that effectively can be controlled by a higher level. The more detailed control required, the fewer subordinates that can be controlled. The benefit, however, is that the traditional number of levels in the hierarchy of centralized organizations can be reduced. By extending the span of control the disadvantage of time-consuming reporting/information flow inherent in centralized models will be reduced. We will thus be able to take advantage of better direction of effort without losing the benefits of maintaining tempo. How far it is advisable to go in the centralization effort before it again turns into a liability still needs a more detailed study.

The more technologically sophisticated munitions are, the more expensive they tend to be. This factor alone will limit available stocks. Increased precision, however, will greatly enhance the effect of individual munitions. Consequently, the amount of ammunition required to accomplish the mission will decline. This will normally require fewer “platforms” to deliver the munitions. This is, admittedly an over simplification, but the point is still valid for the purpose of showing a trend. The net effect is that there will be an increased desire to control and better direct the effect of each munition, thus a tendency for centralization. The increased tendency to couple munitions and platforms into integrated systems further promotes the tendency for centralization. The reach and integration of the some of these systems are so great that only the higher level can control the entire system. To a certain point the ability to better direct actions

and unity of effort is a good thing that must be exploited. By going too far though, the advantage might turn into a liability as discussed earlier. Thus we will need to find a proper balance. Exactly where the balancing point is will not be answered in this paper, although it will be further discussed in general terms.

2. Despite all developments in technology no one has the ability to accurately foretell the future and what challenges it might bring. Although it looks like we are more likely to be involved in challenges at the medium and lower levels of the conflict spectrum, high intensity scenarios like the 1991 Gulf War cannot be ruled out. This means that we have to be prepared to handle the full spectrum of conflicts ranging from traditional large-scale high intensity conflicts, to low intensity operations other than war. Further, we will have to be prepared for rapid shifts in intensity and type of conflict, as well as handling simultaneously occurring challenges.

The current war on terrorism serves as a good example. In some instances the war is best served by employing selected and specialized capabilities in relatively small proportions. In the next stage we might find ourselves engaged in a full-scale high intensity conflict against nation states with conventional military structures. An increasing number of the future challenges will probably occur in so-called complex environments. Complex environments cover conflicts in urban terrain where it is difficult to extinguish combatants and non-combatants. These environments may also include underdeveloped infrastructure, littorals, and or jungle, where good situational awareness is difficult to achieve. All of the above-described environments represent areas were future sensor technologies are least developed. Last year's incident with the CIA controlled *Predator* attack in Afghanistan demonstrates some of the difficulties we face. A state-of-the-art *Predator* located a probable target and a decision was made to engage with its precision guided missile. It later turned out that the target probably was non-combatant. The incident demonstrated the challenges and limitations for sensors to properly identify legal targets in a complex environment.

To meet the challenges of the future we need a broad range of capabilities. Adaptability will be an important organizational aspect. Balanced, multidimensional, general purpose organizations demonstrate the best ability to adapt to rapidly changing situations.[8]

We have to be careful not to concentrate all our capabilities on information dominance and precision strike. Stand off fires are not always the sole answer to solve a problem. History has repeatedly demonstrated this fact. If we get too one-sided we will be susceptible to asymmetrical warfare against our vulnerabilities, i.e., it is not unknown to employ mass against technologically superior enemies and actually succeed. In principle, precision strike munitions/sub munitions can only destroy one target at a time. As these munitions are relatively technologically advanced and expensive there will be limitations on numbers and availability. The enemy can thus employ a mass of relatively cheaper but still lethal systems in a strategy of attrition. In peace support operations, fires are usually not the dominant factor in achieving success although they are often required. Consequently, if we structure our C2 and organization solely on what is offered by precision strike and information networks, we will limit our future options.

We must be careful not to let evolving technologies change war into a computer game. If we do so our efficiency in applying available means will increase but at the same time so will our vulnerability. Even though our actions will be somewhat unpredictable, our center of gravity will be obvious. This allows an enemy to focus his efforts, maybe long before the actual conflict materializes, to come up with asymmetrical or symmetrical means to defeat it. If war is reduced to mathematics and programming, it is just a question of time before somebody with a better computer comes up with the solution to defeat the adversary's system.

3. The governing question when setting up a command and control structure with its supporting organization is identifying who is best situated to make the right and timely decision. Simply stated, the solution evolves around creating the most efficient system that supports the decision

cycle in Col. Boyd's famous OODA loop (Observe – Orient – Decide – Act).[9]

There seems to be an underlying belief for proponents of centralized organizations that the fundamentals of war can be changed. This further leads to a belief that all decisions can be logical and optimal to meet the requirements and that chaos and the fog of war can be replaced by complete clarity and exact situational awareness. Precision strike and information technology has not changed the nature of war. Admittedly our situational awareness and our ability to strike or act more rapidly will increase drastically. But will we know everything? Certainly not. There will still be shortfalls to the so-called "close-to-real-time situational awareness".

Limitations in the type and amount of information that can be exchanged in an information network still exists. All elements of information that in some way can be counted are easy to exchange. Intangibles such as feelings, morale, perception, intensity, etc, are not easy and in some cases impossible to exchange. No capacity to exchange all visual information exists, and none is expected in the near term. Who then will have the best situational awareness if the same amount of information is available in a multilevel information network? The one who commands from a distance or the one who actually experiences the situation? If everything else is equal there can be no doubt that presence gives an edge in situational awareness.

As long as we deal with humans or human made things, unforeseen things will happen. Machines will break down, systems will be degraded either due to technical, mechanical, or enemy countermeasures. Chaos, uncertainty, and friction will still be predominant characteristics of war. This points to an advantage for decentralized systems that seem best able to handle change and friction.

As mentioned previously, centralized C2 structures are extremely vulnerable to interruption of information flow. This is more valid the more centralized the structure. The future information network will be a very visible critical vulnerability. It will probably not come as a surprise to an adversary who will try to exploit it. In other words, we should try to counter this

effect by creating a structure that is more resilient to interruptions in the information flow. In general this can be achieved in two ways. One can either duplicate systems or parts thereof or choose a decentralized C2 model, which by nature provides more redundancy. The latter seems by far the best from a economic point of view.

Despite improvements, the limitations in true situational awareness and the ever present friction points in the direction of a decentralized command and control structure. This has to be coupled with the benefits derived from centralization as discussed in paragraph one of this chapter. So far, it seems that this can best be achieved by reducing the number of levels involved both in planning and execution of operations.

4. Command at a distance, as briefly presented by Gen Franks seems, to point in the direction of centralized command. Does this imply that an enhanced multilevel situational awareness, and ability to act/strike more rapidly/accurately allows us to skip or drastically change the roles of the three basic levels of war? To answer this question we need to discuss what role the different levels play and why they came to be.

Historically we have always had the Strategic and tactical levels of war. The strategic level's responsibility is to define the wars ultimate objectives, to design how available elements of power best can contribute to achieving the goals, and finally to make the needed resources available. The tactical level commands and controls the military forces in order to win the prescribed battles by winning engagements. Command of the different levels was sometimes divided and sometimes invested in the same person. When 20th Century warfare became to complicated due to the geographical scope and mass of the armies, it became necessary to institute an intermediate level, the operational level of war. The purpose of this level was to translate the strategy into tactical military objectives, develop a campaign plan detailing which battles needed to be fought, and providing the right mix of resources in time and space of the battles. Simplified, the strategic level defines the overall aims and provides the necessary

resources. The operational level designs the campaign and facilitates conditions so that the tactical level can win the battles. We also have to keep in mind that there is no clear and distinct division between the levels but rather a fluid transition.

In some less complicated and unique cases there certainly will be situations where it is possible to skip levels. But we cannot base our structure on unusual circumstances. Our C2 and organization must be robust, flexible, and able to handle the complex in order to manage the wide scope and rapid changes of challenges in future warfare.

When the overall strategy is worldwide it is not given to any individual level to simultaneously gain necessary strategic, operational, and tactical insight to accomplish everything. There are to many peculiarities, intangibles and variables between the various region/theaters and type of challenges. This diversity clearly points in the direction for the need of an operational level as part of the structure. There are just too many things to be accomplished and too many decisions to be made for one level to handle by itself.

Another limiting factor is the amount of decisions that can be made by one person. Even though the information is available, the decision maker still has to gain insight in the particulars of the decision. This takes both time and availability. Keep in mind that the operational level commander most often deals in the multilevel environment. Although working in a national operational setting he still deals in regional strategic level matters, whether coalition or bi-national. All of this is time consuming and requires presence. As previously discussed, we also need to keep in mind that several challenges can materialize simultaneously. In fact, this is more likely than not. If all tactical level decisions are added to the operational level, the amount of necessary decisions will increase dramatically. The centralized structure normally has a clear limitation in the number of challenges it is able to direct effectively. Centralization in the extreme would require a military genius like Napoleon and even he didn't succeed in the end. We cannot base our structure on the belief that our top military leaders need to be geniuses as

most often they are not. Rather, they tend to be highly skilled and intelligent professionals.

Another factor that points in the direction of decentralization is the enclosed C2 philosophy that is premised on commander's intent and guidance. One aspect of this is that it normally requires less detailed information and thus should be quicker. Another side is, that by nature it requires possible problems to be thought through beforehand. If all decisions are made by the same level there will be a tendency to skip the policy part since the detailed consideration takes so much effort. Besides, why should it need to develop a policy for it's own decisions? This means that considerations need to be more detailed when problems arise with resulting increase in time consumption. Accordingly, lack of policy tends to slow down the decision making process.

In order to handle the magnitude of highly divergent decisions, there needs to be a subdivision into levels of war. There are so many decisions and requirements at each level, that leaders should focus on accomplishing their own role instead of adding subordinate level decisions. This clearly points to the need for a decentralized command philosophy and supporting organizational structure.

5. If we take a quick look at Figure 1, Chapter 2, we will notice that the present structure not only contains the three levels of war but also a magnitude of intermediate levels within and across each of them. Herein lies a real potential for improvement. While maintaining an overall decentralized structure through the levels of war, the centralization benefits offered by emerging technologies should be used to significantly reduce the number of intermediate levels. This will merge the advantages of better direction and unity of effort, while maintaning flexibility and adaptability to rapidly changing situations.

E. Conclusion

Future war is best served by a decentralized organizations and command structures. Based on the three levels of war, -strategic -operational and -tactical, fast-developing information technology

should be utilized to enhance each levels abilities to effectively execute command and control and to reduce intermediate levels. Further, the precision strike capabilities should focus on enhancing the operational level's ability to shape operations and increase the tactical levels agility and combat power. This decentralized structure will best be able to meet the wide range of possible future challenges and to rapidly adjust to fast changing situations. Further, it will offer the most robust and less predictable structure. By focusing on tactical task forces as war fighters the inherently best-situated level's ability to employ combat power in accordance with rapidly changing and complex environments will be optimized.

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[1] Washington Post Thursday, December 27, 2001, By Thomas E. Ricks.
[2] MCDP 6, *Command and Control*, 91.
[3] Michael O Hanlon, *Technological Change and the Future of Warfare,56-57.*
[4] Ibid, 57.
[5] Ibid, 111.
[6] Ibid, 13.
[7] War Room Report 11-02.
[8] MCDP 3, *Expeditionary Operations*, 56
[9] John R., A Boyd, Discourse on Winning and Loosing, 5.

Bibliography

Books:

O'Hanlon, Michael, *Technological Change and the Future of Warfare*, Washington, D.C: The Booking institution, 2000.

Owens, Bill, Admiral, *Lifting the Fog of War*, Farar, Straus and Giroux, New York, 2000.

Peters, Ralph, *Fifgting for the Future*, Stackpole Books, 1999.

Publications:

Department of the Navy, Headquarters United States Marine Corps, *MCDP 6 Command and Control*, PCN 142 000001 00, 1996.

Monograms and studies:

Boyd, John R., *A Discourse on Winning and Loosing.*

War Room Report 11-02, *"Strike" Concepts and Transformation*, 2002.

War Room Report 16-02, *Effects Based Operations*, 2002.

Department of Defense, *Final report on Network Centric Warfare*, 2002.