NATIONAL DEFENSE UNIVERSITY

NATIONAL WAR COLLEGE

INFORMATION TECHNOLOGY
A DIFFERENCE IN SCOPE OR KIND?

CORE COURSE V ESSAY

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INFORMATION TECHNOLOGY
A DIFFERENCE IN SCOPE OR KIND?

Before the Wright Brothers, air, while it obviously existed, was not a realm suitable for practical, widespread military operations Similarly, information existed before the Information Age But the Information Age changed the information realm's characteristics so that widespread military operations within it became practical

CORNERSTONES OF INFORMATION WARFARE
United States Air Force

I started this paper as an investigation of Real Time Information to the Cockpit (RTIC) which involves providing information from one sensor to one shooter However, I quickly found myself drawn into an investigation of something much larger and I believe, much more fundamental Are we at the verge of a "revolution" in warfare? This paper proposes that we in the military have yet to answer the fundamental questions surrounding information technology's impact on operations, organization, or doctrine In typical fashion we have attacked the hardware problems and left the tougher issues of doctrine and implementation until later Well, "later" has arrived and the quicker we come to grips with these most fundamental issues the better -- for both our military and our nation

As I mentioned earlier, I started this paper because about four years ago I was involved with the early development of RTIC and found its potential fascinating However, even then I could see that no one was working the corresponding issue of how to implement this technology in an operational setting with multiple sensors and multiple shooters In other words, we had proven the technology in a controlled environment but hadn't explored it outside the laboratory where "fog and friction" were sure to take their toll Who would "make the cut" on distributing the information and how could we avoid "information overload?"

Indeed, my research readings took me down a most fundamental path   I found

myself beginning to connect the issues of technology with operations, organization, and

finally doctrine   Therefore, I will begin with RTIC but expand my discussion to include

operational, organizational, and doctrinal issues   What type of organizational structure do

we need in order to take advantage of information technology? What doctrinal

modifications are needed to accommodate an information intensive future? Does

information technology blur our traditional concepts of strategic, operational, and tactical

warfare? The length of this paper will not permit me to offer a detailed analysis of each

subject, but if I simply generate some "food for thought" then I've been successful

However, before I begin let me explain what this paper is not   This paper is not a

discussion of "cyberwar " This isn't to say that this dimension of information warfare

isn't worthy of discussion or exploration, but simply that it isn't the focus of this paper

Computer-on-computer warfare is a fact and will no doubt continue to find its way into

the military's "operational" lexicon However, because of this paper's limited length, any

inference to this type of "warfare" will have to be in passing only This paper will center

instead on those information technologies that include real-time and near real-time

capabilities in an ever expanding "battlespace " We must come to grips with the

fundamental question of whether these technologies offer us a revolutionary capability or

simply new tools to solve old problems Do today's information technologies really

represent a difference in kind or just a difference in scope? To quote from a RAND study

by John Arquilla and David Ronfeldt, Information warfare "is not merely a new set of

operational techniques It is emerging as a new mode of warfare that will call for new

approaches to plans and strategies, and new forms of doctrine and organization" (Arquilla,

20)   Let's see if we agree

RTIC ON A GRAND SCALE
THE NEED FOR AN EFFECTIVE DECISION ARCHITECTURE

*Information technology advances will make dramatic changes in how this nation fights
wars in the future   They will allow a commander's vision and view of the battlespace to
be shared at the lowest level   Because of this, every practitioner of the profession of
arms has a responsibility to understand the impact of information warfare on their
service   From our unique perspectives as soldier, sailor, marine, and airman, we can
then forge a common understanding of how to use information warfare to enhance joint
warfighting capabilities*

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Ronald R Fogleman   Shiela E Widnall

General , USAF   Secretary of the Air Force

Chief of Staff

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In the end, warfighting comes down to decisionmaking   Whoever can make the

"best" decisions in the quickest possible time will prevail   In the tactical sense, this might

be the first warfighter (fighter pilot, tanker, sailor, or soldier) to acquire his adversary,

determine his intent, and fire his weapons   This concept can also be applied at the

operational and strategic levels of war where those in critical leadership positions are

trying to preempt the decisionmaking of

their counterparts   Therefore, in the

aggregate whomever can accomplish this

task with the greatest success will gain

victory (Czerwinski, 13)   We call this cycle

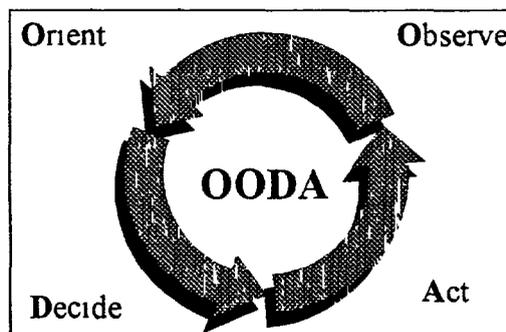of Observing, Orienting, Deciding, and

Figure 1

Acting, the OODA loop or decision cycle (Figure 1)

In order to succeed you must get inside your adversary's decision cycle to continually anticipate and preempt his actions before he can do the same to you   Real Time Information to the Cockpit (RTIC) is intended to do just that   It represents one of the latest uses of information technology to provide a decisionmaking advantage   In this case, it is a very specific capability of transferring information (be it airborne or spaceborne) directly to an aircraft in real-time (Figure 2)   In other words, as the information is collected it is transmitted

Figure 2

immediately to the aircraft and thereby, giving a significant information (decisionmaking) advantage to the warfighter in the aircraft
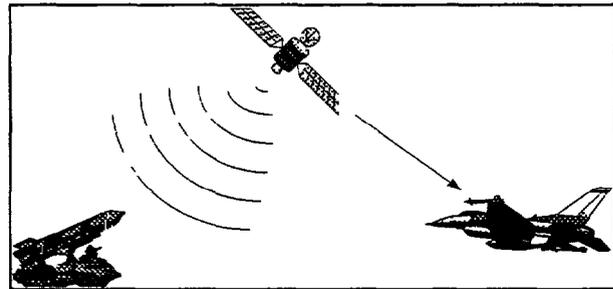
To date, we have focused our attention on the challenge of hardware   How to collect data, electronically transfer it, and then effectively display it   However, most of these formidable problems have now been solved and what remains is the problem of taking them from the "lab" into a working environment -- the only place that matters   Unfortunately, this is where our efforts have traditionally fallen short   One only needs to remember our early and ineffective methods of adapting the tank and aircraft to U S warfighting doctrine   Perhaps we fail because once the hardware problems are solved the issues becomes less scientific and more theoretical, political, and   emotional   For now we can talk about *information* flow but ultimately we will have to address the tough issues of command and asset ownership

We need to create an effective decision architecture that accommodates our technology boom without overloading the warfighter with information that is irrelevant to

his situation   We need to devise an organizational structure that will permit timely

decisions to be made at the optimum decisionmaking level   There are a number of issues

surrounding the effective incorporation and employment of information technologies   The

first issue is the concept of hierarchy and its relationship to time and the second issue is

related to survivability

The military is a very hierarchical

organization (Figure 3)   Such a hierarchical

tradition is born from the necessity to

maintain order in the midst of chaos

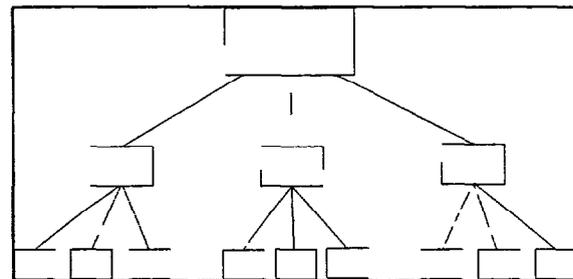Historically, it was this type of organization

Figure 3

that provided the military the ability to maintain control and disseminate information

across a chaotic battlefield   The hierarchical structure provided an effective means of

disseminating information for those who only had limited means (messengers, short range

radios, etc)   However, given today's

world of nearly unlimited connectivity a

flatter, more centralized structure

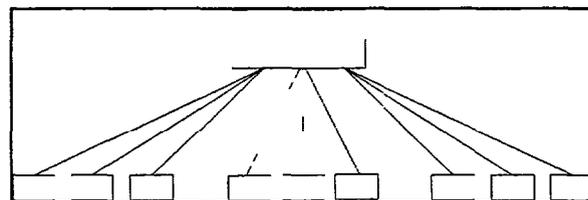becomes optimum   From the standpoint

Figure 4

of reducing decision time, the flatter the

organization the better (Figure 4)   Humans now represent the longest delay in any

modern decision architecture (Marines, 94)   The more human interaction that can be

reduced between the decisionmaker and his implementers (warfighters), the smaller the

decision cycle becomes   However, from the military standpoint there are two tremendous

drawbacks to such an organizational structure   The first is survivability and the second is

micromanagment

Within the military context, we must deal with a dynamic environment where the

adversary is aggressively and quite predictably trying to sever our information lines   He

tries to introduce confusion by separating the Commander from his forces   If your

adversary is able to discern such a centralized information structure, it will undoubtedly

become the focus of his attack and whatever success he has in isolating the leadership will

have a devastating effect on operations

The second concern that the military (and any other organization for that matter)

has in flattening its organization is that such a structure invites superiors to micromanage

Top level leadership, be it Generals or CEO's, will barely be able to restrain themselves

from "meddling" or micromanaging in the affairs of subordinates   The siren song of *real*

time information will tempt them to run even the most mundane of operations   However,

there are two very real drawbacks to this approach   The first has to do with the need to

retain an autonomous capability for wartime and the second is the dilatory effect

micromanagement has on motivation and initiative

Although our *real time* capabilities have remarkably increased, they are still not --

real time   One must be able to consider the information instantly and in the context of the

moment   As stated before, what if the link is broken?   Subordinate commanders must

have the ability and *inclination* to act autonomously   The best method to ensure that they

develop this skill is to make it the default mode   Finally, until robots fill our ranks those

who are asked to go in harm's way will want to have some level of control over their

environment   The morale and initiative that springs from this type of control is palpable

Therefore, the best method proposed for dealing with the failings of a strictly

hierarchical approach in the information age

is a networked approach (Figure 5) The Air

Force calls it Distributed Battle Management

or DBM (Lewis,iii)   It is an approach that is

thought to provide the best compromise for

dealing with uncertainty and time (Marines,

125)   In this method the leader is still able to

exercise control but in a less direct and
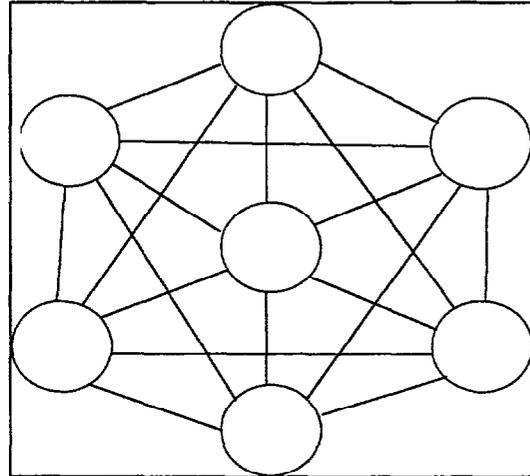
therefore, restrictive way The leader is

Figure 5

called upon to provide his image or vision (Kahan,9 Marine Corps, 88) The analogy

today would be the commander's intent With this shared image, the individual cells are

free to operate at their optimum level of speed and still able to share broader range views

of the operation A networked approach would also favorably address the issues of

survivability and micromanagement Although some time might be lost from a purely flat

hierarchical approach, it would be minimal since all cells would be interconnected and

communicate simultaneously This isn't to say that such a concept is without challenges

Because of simultaneity, there would be a very real need to manage the immense flow of

data Cells would be pulling data from sensors and the net while simultaneously pushing

data to the net as well Several methods of managing this overwhelming flow of data have

been proposed, among them hardware solutions, software solutions, and organizational

solutions This of course cuts to the thrust of this paper, that we haven't yet properly

explored a means of "operationalizing" the potential offered by real-time information technology

Hardware considerations include limiting the type of equipment and providing direct connectivity However, software solutions show the most promise These might include programmable "filters" and improved data processing that apply commander driven algorithms thereby giving him just the information he requests (Marshall, 93) Ultimately, however the organization scheme adopted will determine the final solution Therefore, this is where we need to focus our attention -- at the organization and its underlying traditions and doctrine

The military needs to come to grips with the new information technologies, determine their potential to alter our traditional concepts of warfare, and then get on with the business of adopting it in its most effective form   One of the most fundamental questions is whether the information age has delivered us into a new era of warfare or has simply provided new tools to accomplish old tasks?

INFORMATION TECHNOLOGY EVOLUTION OR REVOLUTION?

"From Plato to NATO, the history of command in war consists essentially of an endless quest for certainty "
Van Creveld

Information, communications, and control are enduring concerns of warfighters, there is much historical evidence, tactical and strategic, that attempting to pierce the "fog of war" and envelop one's foe in it has played a continuing role (Arquilla, 9)   Several examples from history serve to illustrate

Carthaginian forces under the command of Hannibal routinely stationed observers with mirrors on hilltops, keeping their leader apprised of Roman movements while the latter remained ignorant of his   In the most dramatic example of the use of superior information, Hannibal's relatively small forces were able to rise literally from the "fog of war" at Lake Trasimene to destroy a Roman army more than twice its size (Arquilla, 9)

The Mongols were also expert practitioners of information dominance   Scouts and messengers always took along three or four extra horses, tethered, so that they could switch to fresh mounts   This gave the horsemen, in relative terms, something approximating an ability to provide "near real-time" intelligence, almost as from a satellite, on the enemy's order of battle and intentions   In terms of organization, the Mongols employed decentralized command in the field, unlike their foes who were generally required to wait for orders from their capitals   By developing an effective, near real-time communication system to keep their leadership apprised at all times the Mongols combined decentralization with topsight (Arquilla, 12)

The relative importance of information and control took a jump with the advent of mechanized warfare   One of the enduring lessons of blitzkrieg warfare was the value of disrupting the enemy's command and control, to get inside his decision cycle and stay there   However, one of the often overlooked factors that significantly contributed to blitzkrieg effectiveness was the fact that radios were used in individual German tanks   A particularly noteworthy example of a new information technology being effectively incorporated with visionary doctrine -- something this paper proselytizes

With all of these developments in "technology" the size of the battlefield increased while the time it took to pass information decreased   Today, as we combine our

ability to strike at ever increasing ranges with increased accuracy and lethality, does

information technology offer us the tool to revolutionize warfare as we currently think of

it? Some thoughts to consider

First of all, consider the link with the past We have always had information flow

on the battlefield and those who were most successful in command and control were most

often victorious However, our ability to see has normally exceeded our ability to

influence or destroy I would argue that today the ability to see has taken a quantum leap

forward at the same time our ability to strike deep has become a reality All we need is the

communication and decision architecture to make it devastatingly effective This, I think,

would create not just a change in scope but a change in kind as well I say this because as

the "battlespace" has expanded, the ability to simultaneously affect the strategic,

operational, and tactical levels of war has become a reality Air Force directives already

speak of the Joint Force Air Component

Commander (JFACC) being able to

monitor and affect all three levels of war --

simultaneously (Lewis, 6) This creates a

fundamental shift in our traditional ways of

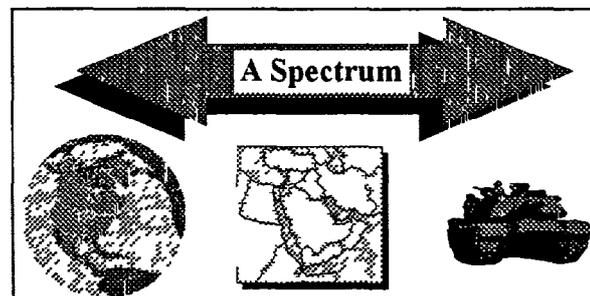prosecuting war (Figure 6) This is not to

Figure 6

say that the three terms become anachronistic but that they begin to blur together and their

relative weights also begin to shift (MacGregor, 33) Consider Desert Storm as an

example The effect of our early strategic victory by air did not obviate our need for a

ground operation, yet many would argue that it did predetermine its outcome In that war

we combined information dominance with the newfound lethality of precision deep strike

weapons to create an overwhelming asymmetry in capability As we improve our ability to communicate the battlespace picture in near real-time will information technology begin to lessen the significance of individual tactical and operational engagements? I believe individual engagements will continue to ultimately determine success or failure in war However, information technology can not only contribute to the success or failure of individual engagements but can "see" their strategic significance *This* represents a fundamental change

So we come to a point of departure If one recognizes the revolutionary trend now offered by information technology, when do we make our break with the past I would argue that because of the nature of information technology and its exponential rate of growth, the sooner we make the break the better Remember the OODA loop The quicker we make the leap and embrace real-time technologies the quicker we can take steps that guarantee our decision cycle dominance This would involve significant modifications to vision statements and perhaps more importantly, budget commitments Ultimately, if we believe that this is where the future is headed, and I do, then we must give these technologies budget priority If budgets are indeed headed downward, what better way to leverage limited funds? The first step is to develop a vision of the future, organizationally and doctrinally, that will focus our hardware efforts

CONCLUDING THOUGHTS

Reams have been written about the impact of this technical revolution on the conduct of war, particularly since Desert Storm However, most of the literature focuses primarily on technical developments, not on how these developments impact doctrine

CORNERSTONES OF INFORMATION WARFARE
United States Air Force

I have seen the future and it is here   RTIC gave me a keen insight into the future that was both exhilarating and at the same time -- despairing   Exhilarating because I saw a technology advance that gave the U S unparalleled decisionmaking advantages   However, I despaired because I didn't then, nor have I yet, seen any serious steps taken towards giving this capability a warfighting edge   We need an effective decision architecture and doctrine to give this technology warfighting relevance

We find ourselves at the same type of crossroads with real-time technologies that we found ourselves in with the tank and airplane   All we saw in the tank was the limited ability to defeat a machine gun   Many thought it was little more than a threat to the horse cavalry and insisted that it only support infantry   It wasn't until some foreign visionaries came along that the U S finally awoke   Likewise with the advent of the aircraft   The U S military establishment fought hard and long to keep it from threatening our "established ways"   Again, we in the U S military had to have foreign officers find an effective military use for a scientific discovery that U S know-how had dropped in our lap   Today's information technologies are *our* tank and airplane

Clearly, information technologies represent a change in "sea state "   Organizationally, the networked approach shows the most promise but what I really am arguing for is aggressive research and testing to *ensure* it is the best approach   To quote David Alberts from <u>The Future of Command and Control with DBK</u>   "These technologies offer opportunities that cannot be realized using the existing organizational approaches "   (Alberts, 87)   Does information warfare represent a fundamental change in warfare? Yes *and* no

It takes the old concepts of battlefield information and elevates them to unprecedented levels   In ancient times the warrior knew only what he could see and only kill what he could touch   With the advent of intervening technologies such as the airplane and gun that battlespace expanded tremendously   However, what we are witnessing now

is a quantum leap in *both* the ability to see and destroy – in *real-time* Therein lies a fundamental change presented by information technologies A second change has to do with the issue of command and who "owns" the battlefield If we adapt the concept of a "networked" battlefield, doesn't that require a fundamental shift in our concept of command? Who is responsible if *all* are responsible? Who *owns* the assets being instantly diverted across the battlefield? A "Commander's" battlespace (the area he can directly influence) is now almost unlimited and can be interpreted without delay The fundamental concepts of strategic, operational, and tactical operations also begin to blur as his ability to influence all portions of the battlespace, simultaneously, becomes a reality

However, one factor that makes this technology no different than those of the past is that for each technology discovered, one's adversary quickly adapts measures to counter it I don't doubt that this will happen again but I don't want to be the one with an early disadvantage Again, given the nature of information technology and the asymmetry it offers, if we don't get this right the first time their may not be a *second* time

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