

AD-A186 679

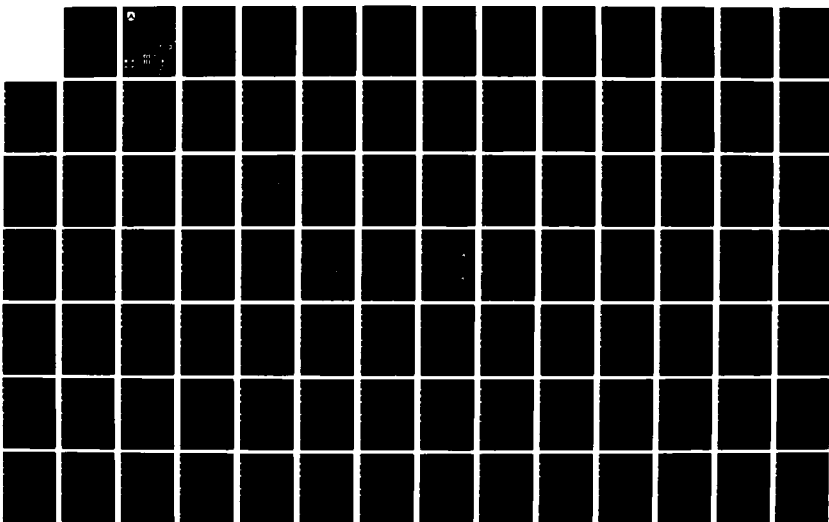
READY FIRE AIM MANAGING TODAY'S TELECOMMUNICATIONS
TECHNOLOGY FOR TOMORROW'S WAR FIGHTING NEEDS(U) AIR WAR
COLL MAXWELL AFB AL J R OFFER MAY 87 AU-AWC-87-158

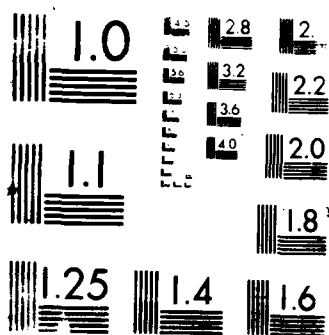
1/2

UNCLASSIFIED

F/G 25/5

NL





4

DTIC FILE COPY



AIR WAR COLLEGE

RESEARCH REPORT

No. AU-AWC-87-158

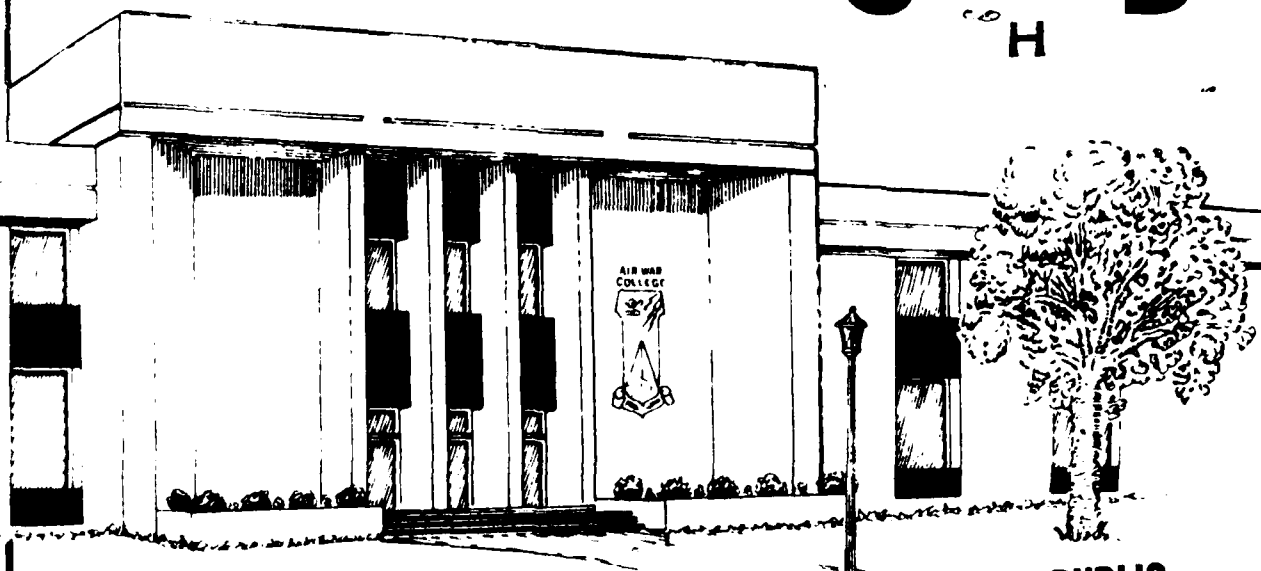
AD-A186 679

READY, FIRE, AIM!

MANAGING TODAY'S TELECOMMUNICATIONS TECHNOLOGY
FOR TOMORROW'S WAR FIGHTING NEEDS

By LIEUTENANT COLONEL JAMES R. OPFER

DTIC
S DEC 07 1987 D
H



AIR UNIVERSITY
UNITED STATES AIR FORCE
MAXWELL AIR FORCE BASE, ALABAMA

87 1 27 014

APPROVED FOR PUBLIC
RELEASE; DISTRIBUTION
UNLIMITED

AIR WAR COLLEGE
AIR UNIVERSITY

READY, FIRE, AIM!
MANAGING TODAY'S TELECOMMUNICATIONS TECHNOLOGY
FOR TOMORROW'S WAR FIGHTING NEEDS

by

James R. Opfer
Lt Col., USAF

A RESEARCH REPORT SUBMITTED TO THE FACULTY
IN
FULFILLMENT OF THE RESEARCH
REQUIREMENT

Thesis Advisor: Major Charles Zimmer
Technical Advisor: Major Charles Zimmer

MAXWELL AIR FORCE BASE. ALABAMA
MAY 1987



Accession For	
NTIS GRA&I	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

DISCLAIMER-ABSTAINER

This research report represents the views of the author and does not necessarily reflect the official opinion of the Air War College or the Department of the Air Force.

This document is the property of the United States government and is not to be reproduced in whole or in part without permission of the Commandant, Air War College, Maxwell Air Force Base, Alabama.

AIR WAR COLLEGE RESEARCH REPORT ABSTRACT

TITLE: READY, FIRE, AIM! MANAGING TODAY'S TECHNOLOGY FOR
TOMORROW'S WAR FIGHTING NEEDS

AUTHOR: James R. Opfer, Lieutenant Colonel, USAF

Provides an historical perspective on electronic telecommunications in war fighting followed by the implications of today's fast-changing world. The author reviews today's information society, the resulting implications of smart weapons systems, and the information needs of even smarter combat soldiers on the battlefield. A description of the current environment provides the framework for a proactive approach to exploiting today's emerging technologies quickly. Provides techniques for moving an organization to capitalize on, and field, certain critical capabilities for tomorrow's war -- one target at a time.

BIOGRAPHICAL SKETCH

Lieutenant Colonel James R. Opfer (B.S.E.E., University of Detroit, and M.B.A., California State University) has been working in combat and mobile telecommunications since 1976 when he was assigned to the European Tactical Air Control System. He served in the Command and Control Requirements Division at Headquarters Tactical Air Command where he was responsible for fighter aircraft and ground anti-jam communications. While there, he also was the project officer for the first prototype testing of intelligence battlefield sensor exploitation and target acquisition systems. His latest assignment was in Presidential Communications at the White House Communications Agency, where he was responsible for modernizing fixed and transportable White House telecommunications systems and networks. He is a 1979 graduate of the Joint Command, Control, and Communications Course, and a recipient of the Air Force Communications-Electronics Professionalism Award for 1980. Lieutenant Colonel Opfer is a graduate of the Air War College, class of 1987.

TABLE OF CONTENTS

	PAGE
DISCLAIMER - ABSTAINER	ii
ABSTRACT	iii
BIOGRAPHICAL SKETCH	iv
PREFACE	vii
 PART I	
WHY CHANGE?	1
CHAPTER 1 Telecommunications and Technology Change	3
CHAPTER 2 An Historical Perspective	7
CHAPTER 3 Ready, Fire, Aim Model of Action	16
 PART II	
THE NEW TELECOMMUNICATIONS WARRIOR	26
CHAPTER 4 Technical Leadership	29
CHAPTER 5 Strategic Education and Tactical Training	51
CHAPTER 6 The Integrated Organization -- Centralization with decentralization ...	57
CHAPTER 7 The Advanced Technology People -- Intel on the Future	71
CHAPTER 8 Managing Change, Create the Future -- One Target at a Time	80
CHAPTER 9 Users and Computers -- Aiming at its Best	87
CHAPTER 10 Electronic Mail -- Everything Starts Here	102
CHAPTER 11 Standards and Policies -- You Can Get There from Here	118
CHAPTER 12 Competition and Industry -- The Force Multipliers	127

CHAPTER 13	Money -- If You Don't Get It, Someone Else Will	135
PART III	THE NEXT TWELVE SECONDS	141
CHAPTER 14	Strategic Technologies that will Make a Difference	144
EPILOGUE	Back from the Future	166
APPENDIX 1	Free Telecommunications Periodicals.....	170
APPENDIX 2	Ready, Fire, Aim Checklist	171
LIST OF REFERENCES		174

PREFACE

The purpose of this book is to provide a different look at how to manage telecommunications in today's fast-changing world.

Telecommunications is no longer about wires and black boxes -- it is about people. We've moved beyond the industrial society to a society based on information creation and distribution. Successful telecommunications leaders will be those who understand this, and can mobilize organizations to exploit the possibilities of today's information-rich environment.

Today, telecommunications is an organic process of which change is a normal part. Gone are the days when one change produced one predictable result -- the linear process. The linear process assumes one cause, one effect.

Communications and computers have matured to a point that they are the very nervous system of the organization.

Change one small thing, and expect more than one result.

Give one person access to information that cuts decision or action time in half, and multiple effects will occur throughout an organization.

The effects of all this on today's intense "smart" battlefield are even more significant. The weapons systems of tomorrow will have this "smarts" distributed all over the battlefield. Success in a future war will go to those who develop the ability to distribute and share battlefield information -- today -- not tomorrow!

The military telecommunications leader must develop an uncanny ability to manage change, to be proactive with the users, and to move quickly to make things happen. To do this, requires a fast planning cycle, a "street smart" knowledge of technology, and most importantly, an innovative, fast moving, flexible planning process that is a very part of the organizational culture.

This is not much different than the situation on the battlefield. Gone are the days of the two or five year planning cycles, as are the days of the slow-paced, low technology wars. Today's telecommunications leader has to be setting a vision, and then acting -- quickly and responsibly. It is now an environment whereby many simultaneous, innovative actions need to be going on, all in a disciplined manner, all headed toward the high priority targets.

This book is not about the latest and greatest, it's about people, and action. I'll cover certain strategic technologies that I believe will give military advantage to those organizations that learn how to exploit them quickly. The ready, fire, aim approach to managing telecommunications gives a "combat" or "warrior" flavor to what otherwise can be a frustrating process; and, most of all, it works!

I chose the term "telecommunications" to cover a broad spectrum, and purposely so. I could use command and control, communications & computers, information systems, management information systems, or a myriad of other terms to describe the art and science of moving information to people who need it to win wars. Today, it is not possible to separate the business of moving the information from the process of storing and processing it and expect any great successes in the final product. With today's technology it is possible to have more information moving through the network than what might be stored or processed at either end. In other words, the network might be the storage medium at any given moment. I will use telecommunications throughout this book. Use the other terms interchangeably to suit your needs.

In an effort to keep from becoming my own worst enemy, I will not use any ACRONYMS, and will communicate in english; using as few technical or occupational unique terms as possible. I realize that by establishing such a worthy goal I run the great risk of alienating all others in this unique business who might believe the user doesn't need to know or would never understand anyway this art and science of telecommunications.

The waiting and hoping days are over; the doing days are here. No one else will do it for you, and you can't afford to wait. Say: "Let's go make the future", and then go do it!

PART I

WHY CHANGE?

He that will not apply new remedies must expect new evils; for time is the greatest innovator.

-- Francis Bacon, OF INNOVATIONS, 1624

The most reliable way to anticipate the future is to understand the present.

-- MEGATRENDS. 1984

Good news! Rapid technological developments, the information age, and events like the AT&T divestiture and deregulation make it clear that it will never be like it was before, but the situation is better than ever for the telecommunications manager to improve the effectiveness of our fighting forces. Bad news! The decision cycle for technology selection and application is getting shorter and shorter. Put that all together, and what do you have? Success won't come to those who keep doing the business of providing information systems and telecommunications the old way. It's time for creative change.

The question: How to do it better? No magic blueprint exists, and I take some risks in addressing this issue from a generic standpoint, not dealing with any specific technology, organization, or management/leadership level. That is done with a purpose. The goal being to define a new framework or a different way of thinking about the business

of fighting wars and having the proper information and networks available to support the munitions or missiles or bombs on target. After all, that's what it's all about.

CHAPTER 1

TELECOMMUNICATIONS AND TECHNOLOGY CHANGE

The world and technology is changing too fast for today's telecommunications leaders to do things the old way. Proactive versus reactive, and taking appropriate or right risks seem to be the way to go. But this demands flexibility and discipline. We need a new approach which matches the pace of change but at the same time takes into account two other very important aspects.

First, the rapid development in smart munitions and missiles. This changes the very way wars will be fought. American military historians often like to emphasize that that we show up for the next war ready to fight that last one. That won't be the case with regard to the smart weapons, where the "rubber meets the ramp", or for new tactics; but will it be for communications? Any future major conflict will be a "come as you are" war. Those who haven't innovated with today's technologies will be ready, but probably ready for yesterday's -- not tomorrow's -- war.

Second, and more important, is the change in our people. Today's military people are more educated today than ever before, and they expect more. We're already seeing the results of new approaches to improving combat capability by drastic changes in leading and managing our people in peacetime... make them responsible, eliminate the layering

and unnecessary regulations, and focus on the results to win the war. Why? We're in the midst of the information revolution, and the results are occurring faster than most would have expected. Our combat forces are becoming knowledge workers, and our new weapons systems demand that knowledge.

We no longer can expect to send masses of troops into battle, knowing only a few basics about marching, surviving, and shooting muskets; all relying on the skill and leadership of a few great men to get the firepower at the right place, and at the right time. Now, with massive and accurate laser all-weather firepower and the greatest technology in the hands of a young tank commander with a million-plus dollar weapon system, the entire outcome of the battle can depend on the skillful application of knowledge by the troops. This demands a new look at the strategic value of communications and information systems. Different information was needed to "get the masses moving and fighting" than to get the surgical high-tech firepower in the right place at EXACTLY the right time in the intensity of battle.

Our war fighting state of the art in telecommunications must match today's weapons, and advances MUST keep pace with the intensity and pace of the war. We need new precepts, guidelines, or rules of engagement if we're to keep the quality of the communications technology up with the quality

of the force that needs and uses it. We need to be able to adapt to rapid change, change is now the business of the telecommunications leader. In today's information revolution, no change means no need for information, either in peacetime or on the battlefield. Our methods of applying and fielding new telecommunications technology need to emulate the fielding of the very weapons systems supported.

The concept of hitting the target has always been -- ready, aim, and fire. Today's smart weapons change that concept to -- ready, FIRE, aim. Those who wait until the aiming is complete don't survive to shoot. The technology in the weapons and supported systems allows the warrior to do the aiming after the weapon has been fired.

Today's information and technology revolution is bringing on more and more technology at faster and faster rates ... a whole new target array of changing capabilities and technologies. Just like the battlefield of today, the concept for fulfilling telecommunications requirements needs to be Ready, FIRE, and then aim. At first glance, one might think this implies risk, but I would say that the risks of doing it the old way are far greater. Challenges? Yes!

THE SUPERMONTH

Is the challenge really that great? Before going further, let's look at technology and telecommunications from a different perspective, the SUPERMONTH.¹ Consider the

five million years that man has lived on this planet and scale it down to a single supermonth. An interesting perspective develops...

- For 29 days and 22.5 hours (99.8% of man's existence) man has been a hunter/gatherer, a wandering nomad with no stable base of operations.

- Only in the last hour and a half did man make his two greatest inventions -- agriculture and the city. All advanced technology evolved from here.

- The last 1 1/2 minutes are the industrial age, and
- ONLY the last 12 SECONDS of this supermonth represent the age of communications, computers, television, and space.

How radical and how fast will the changes continue?

What is so common to us today was totally unfamiliar to most of the rest of human history. "Future compression"² is that name given to the process whereby technological innovation is bringing more and more change at faster and faster rates. Even more fascinating is to imagine what is in store for the next five seconds, to the year 2000. First, a look back in history before those 12 seconds even started. Where were we with war fighting capability and how important was telecommunications?

CHAPTER 2

AN HISTORICAL PERSPECTIVE

The Civil War between the states in 1861 saw the first military implementation of electronic telecommunications. Before that time, runners, carrier pigeons, balloons, signalling mirrors, flags, fires and any other creative method that could be imagined to even include cannons spaced distances apart and echoed were means used to communicate battle information.

The year was 1861. The Civil War between the States had just broken out. The telegraph had been patented 24 years earlier, but it had only developed as a commercial service. The military did not see any application for it and was still relying on runners, signal flags and fires, until necessity proved otherwise. An early historian's remarks about the telegraph's use in the Civil War:

A vision of new realities now appeared. A new factor in war was to be ushered in. Its brilliant achievements were not, however, contemplated. Doubting Thomases there were, but necessity was also, and she is dictatorial.'

From the outbreak of the war in April 1861, it took almost eight months to get the telegraph implemented as an auxiliary to war. The initial attack on Ft. Sumpter was telegraphed around the states as news and helped with the mobilization of the Union forces, but most persons viewed the war as one which would soon be over, thus saw no need to innovate with new capabilities. Things quickly changed. The battle of Manassas (July 1861) had no telegraph. The only sign given or received was the signal gun. About that time, Major (later General) Albert J. Myer had a small group from the Signal Corps at Fortress Monroe and was instructing them in the mysteries of the morse code. His branch (Signal) was rather experimental, and like most of the army, had been rather neglected before the war.²

By November 1861 a large group of officers was instructed, and attached to the Army of the Potomac. At one time it was said they signaled from Georgetown DC (their Headquarters) to Maryland Heights, via intermediate stations.³ Other armies were soon formed and signal officers were formed right along with them. The Corps expenses best illustrate its growth. The budget grew from a little over \$192,000 the first year to over \$800,000 a year by 1864.⁴ For those days, this was a considerable expense for an auxiliary war item, thus demonstrating the importance the Union Army placed on the telegraph.

Those early days of electronic telecommunications in war saw both heroes and innovators. As early as August 1861, the Signal Officer of the Army, Major Myer, proposed to organize a Telegraphic or Signal Train to accompany the army on the march. In addition to the officers and enlisted men, the train cars were to carry all items needed for signalling, including temporary telegraph equipment, telescopes, and aerial rockets.⁵ But Major Myer was not satisfied with the standard telegraph terminals. He directed a new device named after its inventor G. W. Beardslee, that "would not require any batteries and could be operated by anyone who could read or write, after a day's practice."⁶ The unit used magnetic rotors and a complicated dialing mechanism, its intent being to allow the direct transmission of alphabetic letters.

Myer's enthusiasm for a new device even threatened commercial telegraphy, and a bitter rivalry ensued. Thirty trains were fielded, but the total complication of the Beardslee machine made it less than a success in the field. The superintendent of the recently militarized commercial telegraph system subsequently convinced the war department that there could be only one military telegraph service supporting the war. Major Myers was relieved of his duties in signal corps and all trains were turned over to the Superintendent of the US Military Telegraph Department, never to be used for the remainder of the war.

The electronic communications era in war fighting had been less than two years old and yet it had seen the first case of innovative vision and risk taking, followed by technological failure, and all fueled by bureaucratic in-service rivalry. Myers probably had the vision of what was later to become the keyboard teletype, something that war fighting did not see until the next century.

As with any new implementation, there were heroes who discovered how to improvise for the war effort. One story recounts how an operator, Capt W. G. Fuller did not have a telegraph instrument at his station when the Union line reached it. The Commander, General J. T. Boyle was greatly provoked and threatened to shoot Fuller. To Boyle's astonishment, Fuller sent messages by cutting the telegraph wire and using the ends as a key. To receive messages, Fuller held the wire on his tongue and received the dots and dashes as electric shocks. The General was said to then pat Fuller on the back and say that he was "too useful to be shot yet."

The Union forces learned how to take advantage of this new capability and used it creatively throughout the war to great success. The telegraph became known as the "wonder working wire". General Sherman wrote in his memoirs:

The value of the magnetic telegraph in war cannot be exaggerated, as was illustrated by the perfect concert of action between the armies in Virginia and Georgia during 1864. Hardly a day went by that General Grant did not know the exact state of facts with me, more than 1500 miles away, as the wires ran... This is better than the signal flags and torches. Our commercial telegraph lines will always supply for war enough skillful operators."

The Confederate forces did not regard the telegraph as essential. Even though they had the resources, they never extended the telegraph lines from the main offices to the armies, nor did they establish a military telegraph agency. The Union learned to fully exploit the value of this new electronic technology quickly, something that might deserve more attention from historians.

Post war analysis showed that the Union got more for its costs on the teletype than any other war service.¹⁰ Over 15,000 miles of lines were installed in four years. Total costs were \$2.6 million to operate the telegraph in support of the war. The 6.5 million messages sent over the system averaged 40 cents per copy. Today, one can send electronic mail from a home computer through a commercial service like MCI Mail™ to over 2 million users at a cost of less than 50 cents per page. Translate this to "then year" dollars, and the 1865 costs for today's electronic mail message would be hard to measure.

How did those alive at the time measure their progress and what vision did they see of the future? In 1882, ten years before the telephone started to be of general use in some big city areas, the comment:

That we may better appreciate the telegraphic advantages we enjoyed during our late war, it will be found useful, as well as instructive and entertaining, to note what steps mark the progress by which we have outgrown all former means, and reached the acme of human inventions, the electric telegraph.''

Before moving on, let's reflect on what all this history shows. To do this, I need to get slightly technical. Today, we know the value of all-digital communications in battle, and technology now gives us the capability to do it much easier than ever. But if we think about it, the United States fought a four-year war using nothing but ALL DIGITAL telecommunications ... over 120 years ago. It was the Civil War! The only means of communications was the Morse telegraph, and it was digital -- make and break connections on an electrical wire. Compared to today's digital communications, one could consider the dots as ones and the dashes as zeroes. The human telegraph operators performed the function that microprocessors do today, translating the dots and dashes (ones and zeroes) to words. Just think how difficult it would have been for Captain Fuller to read an analog signal with a wire held to his tongue!

Not much has changed! Technology has been added and the dots, and dashes move much faster today. Over 120 years ago, an operator penned the words on paper as the dots and dashes were received. Then a messenger, often on horse, and delivered the message to the general. Now, we can do all this with the microprocessor direct to the general via wireline or tactical radio/satellite links.

But one thing did change between the civil war and today. That was the telephone!

About ten years after the Civil War, Alexander Graham Bell had been trying to perfect the telegraph by using harmonic tones to send more than one message at a time over the over the wire. He discovered, by accident, that the wire could send not just tones but human voice itself if the flow of current was uninterrupted (or analog rather than digital), and the telephone was born in 1876.

We spent the next 100 years perfecting this analog technology. By the late 1890s the telephone became of general use. Developments during the first half of the century focused on improving techniques of transmission and switching. In the United States, phone service grew from 10 million in 1915 to 41 million by mid-century. War fighting and defense communications adopted the telephone along with the teletype and the radio to enhance all forms of battle management and reporting. Radio was a big breakthrough, and it changed the fluidity of communications in warfare. The

radio and wire communications technologies developed along parallel, but separate tracks, both analog, until the second half of this century... the last 12 seconds of the supermonth.

The computer, the transistor, the microprocessor, and the space age ushered in the environment for a new telecommunications era. Finally, in 1982, the AT&T divestiture and the new wave of deregulation fueled the revolution which helped bring us faster into a world where competition, information and telecommunications have taken on whole new meaning. Digital telecommunications now became the goal of both industry and the military.

All the rapid change and the competitive opportunities! Is this bad or good? It's great! And we're getting back to basics -- digital -- with only a hundred year diversion, and great developments in technology.

Private industry has discovered what the military has known for years --the strategic value of timely communications and information. Before, industry knew who their competitors were and how they would react. Now, it is a whole new ballgame. Those industries who are surviving today are in a constant state of "combat", even the big corporations like AT&T, and IBM. Here is where we have the greatest advantage in getting telecommunications capability in the hands of the war fighting forces. Before, the military was a unique entity demanding from industry command

and control systems, and paying a high price often for poorly developed ideas or misunderstood needs. Now, we have a great opportunity to capitalize on the combat lessons from industry, both winners and losers.

The networking opportunities both in terms of connectivity and hardware/software are amazing and growing every day. Opportunities to capitalize on industry developments are everywhere, and we can probably ride on that bow wave for a long time to come, for at least the next five seconds of the supermonth into the 21st Century. It's not, by any means, a free ride for the military. Our real combat fighting needs still differ from private industry. The stakes of failure are higher.

CHAPTER 3

READY, FIRE, AIM MODEL OF ACTION

Change will not slow down. Its pace will quicken as increasingly sophisticated information technology speeds up the flow of knowledge from sender to receiver. In his best seller, MEGATRENDS, John Naisbitt talks about the collapse of the "information float", as the pace of communications technology accelerates more and more. This information float is the amount of time that the information spends in the communication channel. As we move to capabilities like electronic mail the information moves instantly and two people conduct business in a matter of minutes or hours, rather than days or weeks. The result: acceleration of life and commerce.¹ Overlay that simple example on other areas like electronic banking and research and one quickly sees that the pace can become faster and faster as information transfer moves at faster and faster rates.

The access to more and more real time information is changing the way we live, and our views of the necessities and possibilities. Telecommunications, being the collapse of this information float, becomes more and more the agent of change. Give a person the knowledge that he/she needs sooner and you've empowered them with the ability to act sooner. Multiply that throughout an organization and the overall change is dramatic. This resulting change is not

linear, it's organic. Just one person acting sooner causes any number of multiple effects.

No longer is telecommunications a utility. It is a part of the very resource structure and culture of the organization. As fast as the organization's needs change, the telecommunications networks and information systems will be expected to keep pace.

A critical success factor in today's military war fighting capability is how to manage this change. Ma Bell no longer provides "one stop service and most of the technical expertise, and the telecommunications manager made sure the system gave the users what they wanted."² Now, telecommunications pervades the organization. The telecommunications manager needs to be the organizational change agent, the technical guru with vision, and the operational manager all at the same time. This also means we cannot manage war fighting communications and information needs the way we did before. It calls for a new way of looking at the spectrum, from the organization to the technical requirements. To put the concept in a war fighting context, the shift to filling requirements must change from ready, aim, fire to ready, FIRE, aim.

Not surprisingly, the focus of management has to change to shoot when ready or loose the battle, or the war! This does not mean managing telecommunications is something to be done frivolously. On the contrary, it takes a disciplined

approach that can only succeed with a strong technical vision, and a complete understanding of the organizational and wartime needs.

Why fire before aiming? For the same reasons smart weapons are fired before the aiming is complete. Today's weapons are aimed or guided to the target by complex sensing and guidance systems that either take over after the weapon is fired, or follow designators such as lasers which guide the weapon to the target. The targets are moving, the battlefield is intense, and firing before aiming gives more time to the disciplined, precision aiming required to hit the targets.

How can this work for telecommunications management? Figures 3.1 and 3.2 show the two concepts and why the benefits of the ready, fire, aim approach in today's world. Figure 3.1 is the traditional ready, aim, then fire concept. Once ready, the targeteer spends a lot of time aiming before the weapon is fired. After firing, the weapon is on its own momentum -- able to hit the target as long as the target doesn't move. It's aim, fire, and then hope the weapon hits the target.

Compare this to the earlier days of telecommunications where the change cycle was slower, and we had a lot of time to get ready. Planners could afford to stretch the planning cycle and take time aiming. Then, it was just a matter of waiting for the new capability to arrive. Technology and the

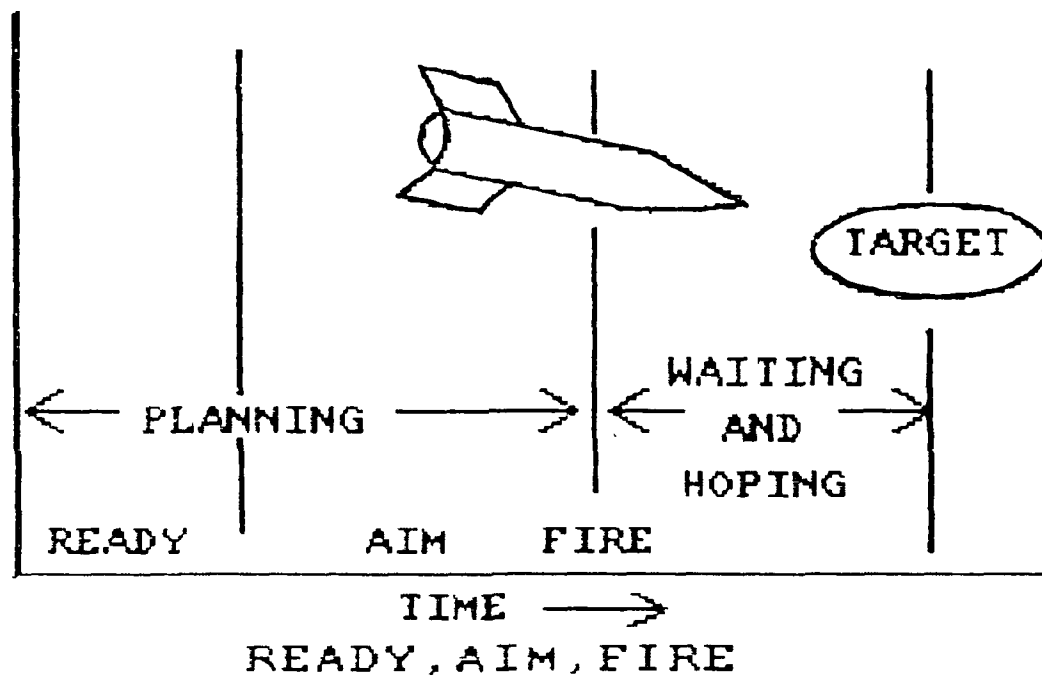
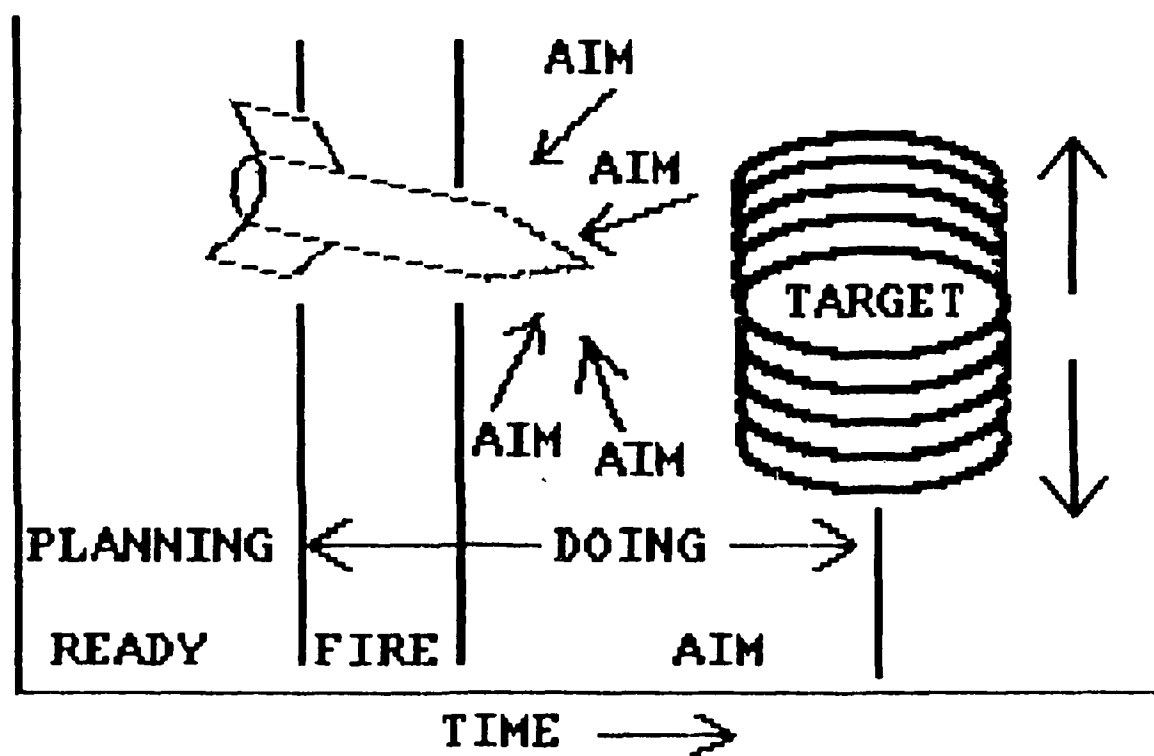


Figure 3.1



READY, FIRE, AIM

Figure 3.2

demands of the user didn't change fast -- the target stayed still. And the weapon, or project usually went on to hit the target because the target never moved fast enough.

Contrast that approach with the ready, fire, aim model in figure 3.2 where instead of "shoot and hope", it's shoot, and then aim all the way to the target. In both, the target is at the same point in time, but the second model recognizes that the target is constantly moving. At first glance, this might look like a reckless or risky approach to doing business. Actually, it is just the opposite. Managing telecommunications projects under this model requires earlier commitments (the firing) to keep up pace with faster technological change, followed by a constant and disciplined aiming all the way to the target.

This approach requires commitment throughout the organization. The goal, as in battle, being to fire as early as possible. The result will be more time to do DISCIPLINED aiming all the way to the target, and by all players involved in the firing decision. The major difference between the two approaches is that the early firing commitment followed by active aiming makes more time for doing rather than planning; time for making mid-course corrections as necessary. This model is the framework for the remainder of this book. Several ideas will follow this approach, so a little more discussion on each phase, ready, fire, and aim before we get to the action part of the book.

READY

This is the stage which says: "Hey, we have to do something." It sounds simple enough, but this is the most critical stage, just as in being ready to go to war. With the pace of change today, it is not difficult to get the urge to do something. Being ready is being defining a requirement or innovation in terms of the future, and having the determination and vision to act. If you plan to search for all the facts before being ready, forget it. Facts don't create vision, opinions do. Uncertainties and risk are inherent in vision, just as in war.

Today, the telecommunications network is the basis for all organizational and mission innovation. Being ready is the result of everything from having technical competence to having the organization structured right to be able to make the change. Again no different than readiness for combat. In combat a unit would not be ready to fight without a leader. To be ready for change or innovation, a telecommunications organization needs technical leadership. If you're afraid of technology, then don't go to into the war. Like being afraid of combat, it won't work! With technology, one has to get in there and take some risks, just like war. You won't win by sitting back and waiting. A technical leader, in addition to being "street smart" in telecommunications developments, understands the values of

the organization, its culture, its mission, and what is important to the people.

But most important is vision. You're not ready until you have a vision, or target. Just as a fighter pilot does not fire his weapon until he has maneuvered in the correct position, and knows his target, the successful technical leader won't commit to action until ready with a target or vision in mind. However, today's pace of technical change is similar to an intense combat environment on the battlefield, success only comes to those combat troops who are ready all the time, or can recover the quickest from failure. Likewise, the telecommunications leader needs to foster a proactive organization, ready to act in a target-rich environment.

FIRE

When ready, FIRE. Don't wait until the next piece of information arrives on the desk, or industry announces the next breakthrough. Again, as in intense combat, the soldier who waits when the target is there will be the loser. In telecommunications, firing is making a decision to head to the target, or make the vision happen. That's all! It's taking an action or betting on your people to make an innovation happen. It keeps better from being the enemy of the good, but it also forces constant innovation to get to the target. It's shooting at one of those targets in the

target-rich battlefield of telecommunications technology. Today, in telecommunications you're shooting a moving target. Fire! Then aim and dodge and dart along with the target.

AIMING

Today's smart weapon is continuously aimed as it heads toward the target. The aiming might be done from within the warhead's nose or from external sources, such as laser designators. At any rate, the weapon won't hit the target without constant aiming.

The same analogy holds true for telecommunications management today. From the time the decision makers decide to fire until the target is hit (or missed), new technology can develop, the target can change, standards can develop, or a host of other changes will occur. Constant aiming must be the name of the game, or battle. It's no different with the target on the battlefield. For many reasons, the smart weapon might once in a while fly over the target and either go onto another, or miss everything completely. In telecommunications, it's no different. The successful organization keeps constantly aiming the innovation (or project) toward the target. Aiming isn't just the job of the technologists. Any number forces come into play depending on the size of the project. The users are a critical aiming force; keep them out of this stage, and

you probably won't hit the target. Group dynamics and internal politics influence the aim.

For whatever reason, sometimes it will be more advantageous stop the aiming energies and let the weapon (e.g. project) fly on. Again, in telecommunications as in war, there are risks, and some firings will end up as failures. Also, as in war, don't fire too many expensive smart weapons at the low priority targets.

PART II

THE NEW TELECOMMUNICATIONS WARRIOR

From an information viewpoint, what would we define as utopia in war? Probably all answers could be condensed to something like ...

Everyone, everywhere (in the battle or anywhere else in the world), having all the information needed to be able to do his or her part in support of the battle at exactly the precise time required. All information regarding the battle would be available to all players, with anyone being able to communicate with anyone else instantly. The result: A completely synchronized effort, much like the players in a symphony orchestra.

Given unconstrained funding and continued technology development we would achieve this utopia at some future time. Fortunately, we all know the reality of the situation, and are willing to save the utopia goals for the next generation. But, exactly what are we ready and required to do given today's situation? John Gantz, a leading telecommunications analyst, gives some insight:

- In ten years, computer based devices have reached a U.S. per-capita penetration level that took the telephone 75 years to reach.

- A computer first telecommunicated with a terminal in 1940. Since then, the growth rate of remote computer terminals was...

- 1970, less than 200,000
- 1980, less than 4 million
- 1990, projected to be over 50 million

- The installed processing power of computers and computer-based devices doubles every 18 months.

- By 1990, more than 60% of the 120 million telephones in the United States will connect to digital systems.

- Two thirds of all computer processing power is now used for transaction processing, and two thirds of that is on-line and interactive, or on-line and nearly interactive.

The point Gantz makes is that the central application of computing is changing from data processing to information access and delivery. He goes on to say that "voice and data are becoming software variations of a platform telecommunications capability." Voice and data are no longer separate technologies. They are part of the much more powerful whole -- information systems technology.¹

All this sure sounds like a stage set for combat, plenty of opportunities for risk, innovation, constant change, and clear winners and losers. On the battlefield of telecommunications, given the options available today, we can make great strides toward utopia. Some actions might be accomplished with pre-emptive strikes, others in a low-intensity conflict scenario, but all will involved a coordinated effort on the part of technical leaders who understand the needs of the organization as well as the mission.

Clausewitz talked about the "fog and friction" of war. There are both clear spots and fog, and a lot of friction in the world of telecommunications management today. This part

presents way of managing telecommunications using the ready, fire, aim model as a framework of action. Key to this approach is an understanding of the role of the technical leader, the needs of today's military knowledge-worker information based organization, and the process of managing change.

CHAPTER 4

TECHNICAL LEADERSHIP

The new leader is a facilitator, not an order giver
-- MEGATRENDS, 1984

Managers are people who do things right, and leaders are people who do the right thing.²

Unfortunately, after reading this far it might look like bad news for some who consider themselves good leaders. Look on the positive side. If you are already a good leader, it's easy to be a great technical leader. Today, interpersonal skills, and all the other attributes of great leaders are significant stepping stones to success. Add technical "street smarts" on top of that and you have the makings of an icon in the telecommunications profession. If you're not already a leader, this chapter is not leadership 101. It's about being "street smart" on today's telecommunications technologies, and more!

Today's military telecommunications managers has to have an understanding of the bigger picture and the roles they can play to mold the information flow, and even the basic structure, culture, and mission of the organization.

In earlier days, the user demands were: "Give me more communications and computers to do my mission better." Those days tended to be reactive rather than proactive. Today, it will be: "How do we restructure our information flow, networks, and the organization itself to do the mission more effectively?" The technical leader MUST play

a key proactive role -- on the high ground -- leading the charge. The old days of being a telecommunications operations manager are over. Now, the challenge is to manage operations, and along with with it, day-to-day innovation. A technical leader has to have all the aspects of a good leader, and must be able to attract and energize people to an exciting vision of the future.

Where does today's technical leader fit into the forces of the organization? The answer: somewhere among these, or similar, forces:

- The technicians, or groups who are suspicious of all who speak in futuristic "big picture" visions and talk as though everything were easy to implement.
- The "techie nerds" who know how to do a technical job well, and can be invaluable to the organization. But don't let them near the customer, or user.
- The accountants, or "bean counters" who question every aspect of change and believe and investment in telecommunications/information technology should be treated like a utility, the only growth being for inflation.
- The programmatic "bean counters" who need to see a detailed schedule for every action for the next ten years, and believe that every action must follow a linear plan with no deviations allowed for innovation or technology developments.
- The "bosses at the top" who are beginning to realize

the value of communications and information systems, and would like to make changes, but are afraid to ask any questions out of fear of "looking stupid."

- The "one-stop shoppers". Or those who still believe that as soon as Judge Greene leaves the scene AT&T will handle all our problems again. Also, might think we the U.S. had the best telecommunications system in the world that it was ever going to have in 1982.

- The bureaucrats who believe that every telecommunications need should follow the formal "requirements/validation cycle", but have no idea how to adapt the bureaucracy to today's rapid changing needs.

- The technology gurus or hobbyists who believe that the newest and greatest is needed everywhere right now.

- The organization "high priest" who has been there forever and knows why everything can't be done, because we tried it ten years ago and it didn't work.

- Those who "screw their shoes on every morning", and want to minimize all risks before taking any action

- Those who are just "doing their job" and want to be left alone.

- The higher headquarters "weenie" who doesn't like the idea.

And there are more! The point here is that the successful technical leaders are able to position themselves between all these organizational forces, and build the new

forces that make things happen quickly. They become the heroes on the battlefield of the bureaucracy, both to those outside the organization and to those who work with or for them. They've mastered the art of ready, fire, aim.

THE VISION ... STRATEGIC THINKING

Strategic planning is worthless unless there is first a strategic vision.

-- MEGATRENDS, 1984

Real time information is changing the way we live, work, and FIGHT! Today's technical leader realizes it's no longer the enough to move information from here to there in a cost effective, timely manner. It's now time to ask the question: "How can I use technology to change the way we operate to alter the outcome of the mission ... of the battle?" The real edge comes comes not from technology itself, but from the creative use of technology. No technical leader in the telecommunications business today succeeds without a vision. Just as the combat leader has a picture of the battlefield and how he desires the outcome to look, the technical leader has a picture of what the desired state or "the future" will look like.

Looking at the ready fire aim concept, vision is identifying the target. The technical leader mobilizes the organization to share a sense in that direction toward the target. Setting the vision isn't enough, an entire process

needs to be instilled in the organization. The successful technical leader insures enough latitude is in this process to allow for innovation. Compare it to the battlefield, where the objective (or vision) is to take the hill. Everyone knows the objective and in meeting it all are expected to survive the rigors of combat by whatever changes are needed, as long as the objective is reached.

In this business of telecommunications, it is often difficult to get all the masses thinking correctly or accurately picturing something that has never existed. There are technical, economic and cultural difficulties. Peter Keen suggests a more formalized process to help build the shared vision.³ It has three goals which I've adapted to the military needs:

1. Shift the focus and terms of debate for telecommunications from technology to the mission, and from cost to benefit to the mission or organization.
2. Provide a forum for sharing views and building momentum. Bring the rest of the organization into what has previously been a technical debate.
3. Send the message across, down, and up the organization. Of course, this means you need the boss's support.

ORGANIZATIONAL FACTORS... MAY THE FORCE BE WITH YOU!

Information and communications technology today greatly exceeds the roles and needs of the traditional organizational structures. Any significant technological innovation or change cuts across all levels, horizontally and vertically. To accomplish any major change or action requires one to focus organizational forces in the same direction. And these forces do not align themselves according to the organization chart. Complex organizations today have competing interests, and goals. The key to productive change lies in learning what these forces are, and in mobilizing them in the same direction. The forces are many, but get three under control and the change has a much better chance of succeeding. These are the technical aspects, the mission aspects, and last, but by far least, the culture of the organization.

Figure 4.1 shows these three key organizational forces as overlapping circles. The degree to which these three circles overlap in an organization determines how easy it will be to build a shared vision, and cause action toward a target. Where all three overlap is the center of gravity for making any productive change happen. Of course, the ideal situation would be an organization where all three overlapped exactly on top of each other, the truly integrated organization. The technical leader has to have a fairly good idea how much the circles overlap in the

THE ORGANIZATIONAL FORCES

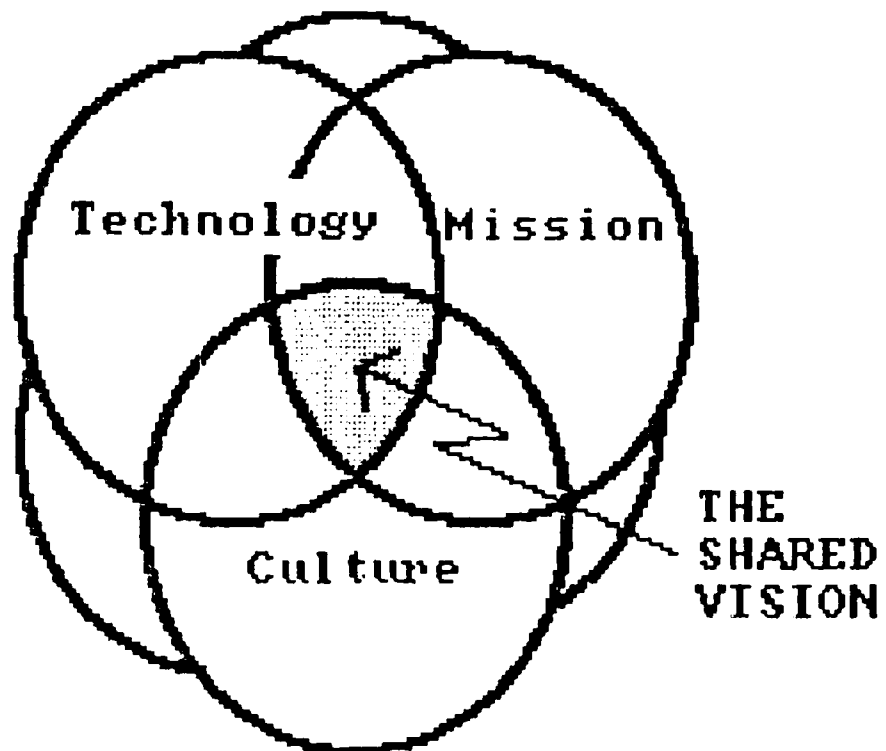


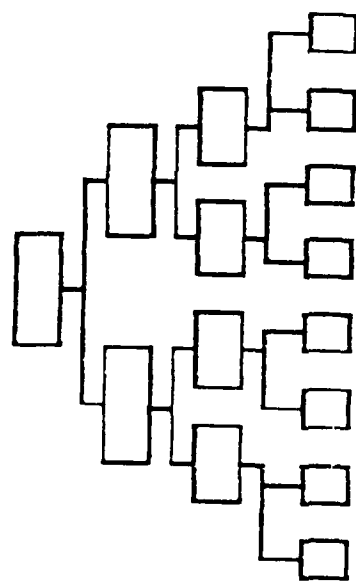
Figure 4.1

organization. If they don't overlap at all, the task is to start the forces going to get overlap. How? By finding, or creating, and nurturing the champions in each circle who can help pull the forces together. The vision is clear to those in the middle, so you don't need to spend much time there. Work on the areas where situations and convictions appear foggy. In the end, it will be those in the middle who are the active aimers in the ready, fire, aim concept. Those in the middle have to be the champions for the vision. One very critical point! If the "big boss" isn't in the middle, any meaningful vision will be a real challenge to define and achieve. If senior management doesn't share the same vision as the technical leader, and has no part in the culture of the organization, forget hitting a meaningful target!

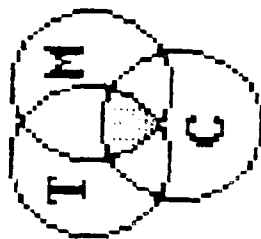
Of course, the ideal case is where senior leadership in the organization creates the vision and pulls the organization's technical and mission players together to "make it happen. But what if that's not the case? The technical leader has two choices: Give up and go at it alone, resulting in almost guaranteed failure. Or build a champion or two at the senior level, and begin as a team to "pull the organizational circles together."

What is the beauty of this concept? Look at the circles again. There is no organizational chart. It is futile to try and mobilize the organization toward a vision through the organization chart. Figure 4.2 shows a generic pyramid

MOVING THE ORGANIZATION



THE ORGANIZATION CHART



THE ORGANIZATIONAL FORCES

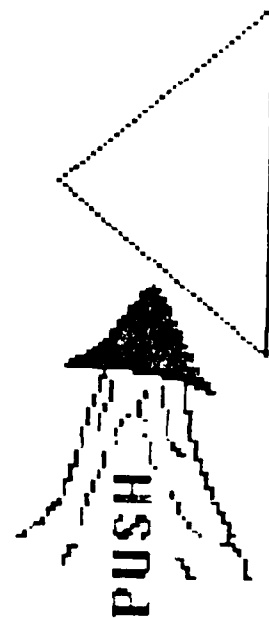


Figure 4.2

organizational structure contrasted with the three circles of force. Trying to get an "organization chart" moving is like trying to roll a pyramid. But, integrate the circles totally over the top of each other, and just a little push will start the whole glob rolling. Which one would you rather deal with?

To get a better idea of what these circle mean, some examples are in order. Virtually anyone, or any part of the organization, can be categorized in one or more of these circles.

The culture circle is very important in an organization having deep roots in tradition and history, as does the military. McKinsey and company define culture as "the way we do things around here."⁴ Who causes the cultural forces? Everyone. But probably people who have been around for a long time, the secretaries, the civilian work force. Also, the cultural forces in an organization like the military are very influential and deep rooted. To ignore them is organizational suicide. We'll talk more about this later when discussing change. It's also the military traditions which are forces one must be consider when building and trying to achieve a vision.

The technical forces would most often be influenced by people like software programmers, maintenance technicians, or engineers, and the like.

The mission forces are the "pointed end of the spear."

It is this area where the main concern is "rubber meeting the ramp", or getting "bombs on target."

It doesn't matter how one views various people or groups with regard to these influences. What matters is the relationship to the areas where the three circles overlap or have forces in common -- the center of gravity. Take the department or group responsible for the centralized computer processing in an organization, the "computer room." Does it matter what circle they are put into? No. Not like it would if one were trying to use the organization structure as a model for selling the vision. What matters here is the relationship to the center where the circles overlap. What this three force concept recognizes is that informal structure that really runs the place and makes things happen.

I'll talk more about the integrated organization later. Now, it's important to understand the concept and the role the technical leader must play to be successful.

Going back to those perceptions of people types: the techie nerds, the bureaucrats, the bottom liners, etc. All have their place in these circles and all can, and will contribute their strengths toward the shared vision. The good technical leader knows this, the great technical leader exploits this. An example: the techie nerds usually have much to contribute as long as you can let them sit in front of the computer all day and tell them specifically what

problem to solve. Give them a problem in the morning and it's solved by the end of the day. Let them interact with the customer, and you usually have a catastrophe. The great technical leader recognizes the value of these people and keeps them near the outside of the technical circle where they can contribute to the vision from the safe distance. These people have tremendous strengths in today's fast moving technical world, but don't put them out there in the front lines to create the vision.

ARCHITECTURE

Out of vision comes an architecture, one that is regularly reviewed and supported by top management. The end product is something like switches, computers, cables, and networks, and much more.

Architecture is strategy. It is the expected outcome on the battlefield at the end of the day's battle, or, from the bigger perspective in time, the outcome of the war. Times or target dates are critical pieces in the architecture. The telecommunications battlefield is a target-rich environment. Without battle objectives, the troops waste weapons and munitions on low priority targets. A well coordinated and thought out architecture helps put the focus on the priority targets; those which have the most payoff for effort expended.

Clausewitz has some comments about strategy that are particularly applicable in this time of rapidly changing technology:

... great strength of character, as well as great lucidity and firmness of mind, is required in order to follow through steadily, to carry out the plan, and not to be thrown off course by thousands of diversions."

Successful architectures have flexibility and can move and dart along with time, organizational mission changes, and technology developments. But that doesn't mean they should change every month. The pace of telecommunications technology is changing fast, but the basic industry building blocks are in place for the next two to five years. One main question has to be: "What should we do first?"

All this requires an awareness of the marketplace, an understanding of the mission needs, and a vision of the future. From this, the technical leader can sell an architecture to top management and the organization. At a minimum, this architecture should cover short and long term strategy. Short term is the next 12-18 months. Long term is anything longer. Think out the next 18 months, and conceptualize at least the next five years. But keep the focus of action on the short term, on what can be controlled now. A one page architecture is ideal. Ten pages is probably too long. The ideal architecture is one that

everyone carries around the battlefield with them, just like the order of battle. Make it too big or classified and it will sit in the file cabinet. Keep the vision simple and understandable. Win the war one battle at a time, but never forget the overall strategy!

Remember, everyone wants to be a part of the future. Nothing can be so important as the name of the project or target. Give the effort a name that suggests a vision of the future, not something that sounds like today's state of being with new technology added. You'll be amazed at how much easier it will be to make the architecture happen. An example. What target or project would you rather be associated with, the Base Engineer Automated Management System, or the Comptroller Office of the Future? Both are projects which add the latest information technologies to military functional areas, but one sure seems a lot more exciting than the other. The name doesn't cost anything, make it alive!

You're at the pointed end of the spear. No one else will do it for you. It's no longer possible to wait for someone else at the top of the organization to create the vision of the future and send it down through the organizational layers to you for implementation. It's your job to set the architecture and the vision, and make it happen.

STAYING STREET SMART... KNOWING WHAT'S GOING ON OUTSIDE?

The military telecommunications manager has a real advantage. Just about everything military in this business is either a product in the commercial market, or an adaptation of commercial product for military purposes. It wasn't that way a decade ago, but it is becoming that way now. That is our greatest advantage. The technical leader CANNOT be successful in today's rapidly changing world without staying current. Four actions are highly recommended for all levels:

1. Read the trade journals, and the FREE newspapers and magazines. They're available for the asking. These periodicals are the best source of information on what is going on, the latest developments and products, the latest standards issues, who is winning on the competitive battlefield. Appendix 1 is a listing of the better free telecommunications periodicals. They're available for the asking. Write for an application today.

2. Maintain an active dialogue and relationship with industry. Take a salesperson to lunch once in a while. You'll be amazed at what you learn. I'll have more to say about this later. Most of industry is eager to get your feelings and needs about products.

3. Attend trade shows and conventions. The cost is worth it, and take along one or two of your best technicians

or younger leaders. No better place to get street smart and get a feel for the pulse of the industry than at one of these shows. And you'll get at least five or six innovative ideas, if not many more. No problem finding where and when they happen, just look in the free periodicals mentioned above.

4. Pay the small price for a market research company that tracks telecommunications and information systems technologies, vendors, and market trends. This service can be an invaluable time saver, and can keep an organization from shooting at the wrong targets. Another help they can give is they assist in the market research portion that the contracting office requires on any major contract. If you're attempting to stay on the leading edge, one of these services is a must.

5. Take your customer to lunch once in a while. Tell them what you think or know you can do for them.

ICONS -- JUST GO DO IT

Where are the icons in this business? Sooner or later one might come along. The commercial world has it's share. Bill McGowen took MCI from the verge of disaster to become the most successful startup in history over such a short period of time. Thomas Watson Sr. saw the computer not only as a number cruncher but also as a storage and retrieval

device for information. But Watson had another success, perhaps even bigger. He used his vision to create IBM, a company, unlike any other at the time, dedicated to the needs of the employee and the customer.

Military history is rich with icons, usually from the war days. In more recent years, everyone recognizes Admiral Rickover as the father of the nuclear submarine. One real icon of the information era, both from a private sector and military perspective is Grace Hopper. Her accomplishments defy the imagination of anyone working in today's bureaucracies. Her motto says it all ... "Just go do it!"

Today's telecommunications and information battlefield is rich in opportunities for the person with a vision. What's important as a technical leader is to be considered an icon within your organization. Even more important is to watch the icons develop within your organization when you let your people experiment and innovate to satisfy user needs. It works. Preach the motto... "Just go do it!"

RISK

One more element is needed to make war a gamble -- chance: the very last thing that war lacks. No other human activity is so continuously or universally bound up with chance.

-- Carl Von Clausewitz

All change or action involves risk. The good technical

leader permits risk taking and tolerates mistakes . If all decisions were made solely on facts there would be no need to consider risks. Few, if any, decisions are based on fact, most are based on opinions; opinions of the strength of the enemy, opinions of what the future will be like, opinions of how a user will react once given new technology.

The key is to take the right risks! Don't always aim to minimize the risks. Ask the question: What is the worst thing that will happen if we do this?" In today's telecommunications environment, there are often greater risks associated with not doing something than with trying it. Often, even in a big project, the best way to reduce risks is to get a head start. The fighter pilot knows that it is important to get to the target early, before the enemy defenses can be scrambled. It's the same for telecommunications, get in early and experiment. Do some ready, fire, aiming at test targets by trying small-scale experiments with the customer or user.

Consider the possibilities. It's easy to look only at the risk associated with failure. Don't stop there. Force the organization to weigh the risks of failure along with the possibilities of success. Sometimes, in telecommunications, it's worth taking a risk just to get smart on a new technology.

In his book INTRAPRENEURING, Gifford Pinchott emphasizes the importance of adding a "summary of risks" section to any

plan. This is where one explains what might go wrong. As a minimum, he recommends covering the opportunities, the threats, and the probabilities. It is not difficult to do this. There are always plenty of people waiting to explain why something shouldn't be tried. When is the last time you saw this section in a plan?

THE ACME COMMUNICATIONS COMPANY QUESTIONS

It is easy to fall into the trap of thinking that because we're not in the business to make money we shouldn't consider things like profit and loss. Effectiveness is effectiveness, in the private or public sector, in war or in peace. Consider the bottom line. Give every project or action the Acme Communications test. Ask yourself the question: If I were the president of Amce Communications Company, how would I do it? Oftentimes, the answers will enlighten you and point out new alternatives to a problem, especially in building organizational structures and in the use of people. Don't allow inefficiencies or organizational layering to exist that wouldn't be there in combat. After all, the American public are our stockholders, and they expect effectiveness and results in peace or in combat.

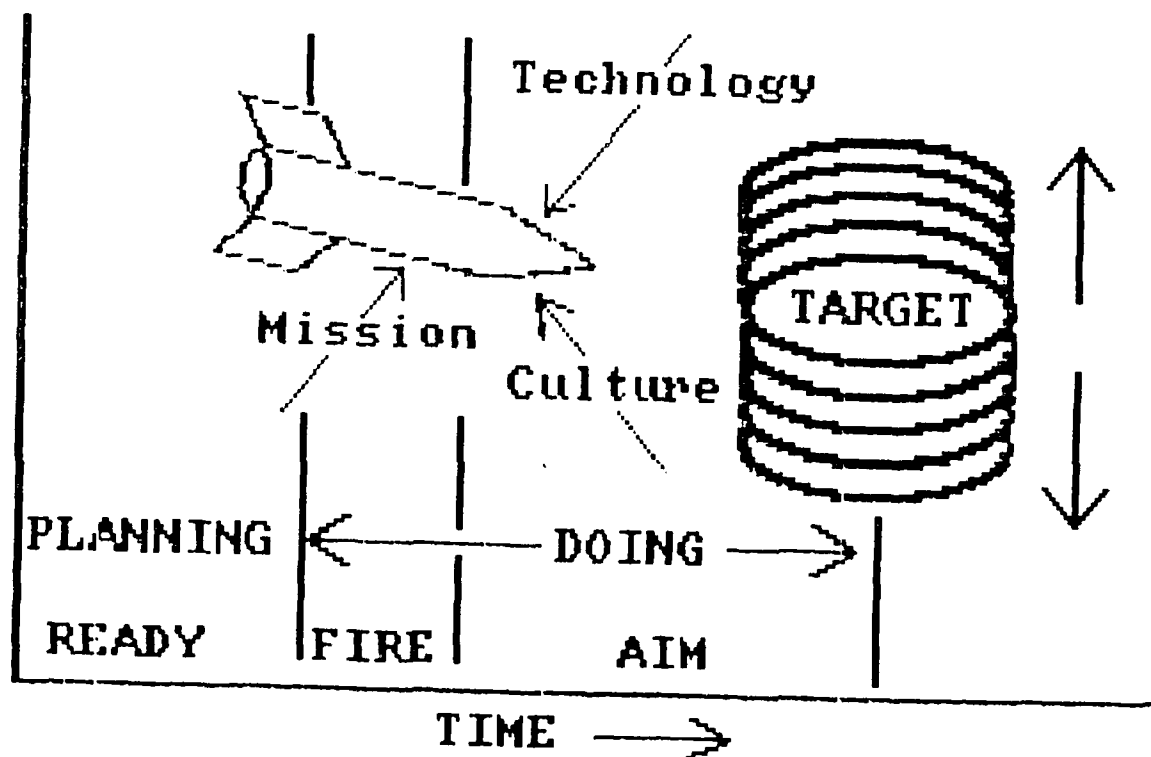
THE COMBAT QUESTIONS

Finally, give everything the combat test. Ask the question: If my organization were in combat today, would we

do things differently? Would organizational entities or layers go away? Would we scramble to get new capabilities, build additional networks, or do things better? Again, the answers to these questions are enlightening. The closer the peacetime operation parallels the wartime one, the more action-oriented your organization will be. Ask these two questions often: If we wouldn't do it in battle, why are we doing it in peacetime? What are we not doing in peacetime that we would have to do in wartime?

READY, FIRE, AIM.

Let's put this all in perspective on the ready, fire, aim model in figure 4.3. Technical leadership in telecommunications consists of creating a vision of change for the organization, and making sure that the right people get involved with the right commitments to make it happen.



READY, FIRE, AIM

Figure 4.3

Organizational forces need to be focused to contribute to aiming the project toward the targets. The mission, culture, and technical forces are key to this aiming process. In any complex organization, it is not just one target, and one project, or weapon. It's more like the battlefield. Ready, fire, aiming is going on all over the place toward an array of targets. The technical leader, like the battle commander, must regularly step back and view the war's progress, asking questions like: Where are we compared to where we expected to be? Should we change the aim to another target? Do we need more firepower?

No battle is without losses. Be ready to deal with the risks of implementing new telecommunications capabilities and technologies. Things never work right the first time. And if they do work right the first time they won't the second time. Plan for acceptable combat losses and act accordingly.

CHAPTER 5

STRATEGIC EDUCATION AND TACTICAL TRAINING

We know how to train people to do technology such as engineering or chemistry. But we do not know how to endow managers with technological literacy, that is, with an understanding of technology and its impact on product and process, markets, organization structures, and people. Yet technological literacy is a major requirement for managers, especially on the lower and middle levels.

-- Peter Drucker

THE FRONTIERS OF MANAGEMENT

The chicken or the egg? What came first really doesn't matter. What matters is that neither one ever goes away. The vision or the education, what comes first? Vision doesn't materialize without education, and education can't happen without a vision.

It's easy to fall into the trap of looking at technical education as a one time experience, then after that follows people, training, and black boxes. Peter Keen emphasizes the importance of strategic education as the mobilizing force that pushes commitment through the organization. Education is the ready phase, training is the fire and aim phase.

STRATEGIC EDUCATION

Strategic education provides information and creates the desire to be ready for the future. A good example of strategic education is the service professional military education schools. The process is geared not toward teaching a particular trade or profession, but to educate leaders on all aspects of our military from history and war, to culture, to the management and leadership issues of today and the future. The key to good strategic education, as Peter Keen emphasizes is "mobilizing for action", not just informing or entertaining.

The next step for the military technical leader is to relate the strategic professional education to his/her real world. Recalling the three force circles puts it in perspective. Each of the groups in those three circles must be mobilized. To get those three circles moving toward a shared vision requires more than a "one way" informational course. It requires constant information flow up, down, and around the organization, some structured and other parts free-flowing and informal. Keen sums up the purpose of strategic education:²

- Change attitudes and build awareness
- Share information and improve communications
- Build skills for participating in planning
- Stimulate action

Strategic education doesn't teach the vision of the

future. Rather the vision guides the strategic education. In implementing new technology, the education needs vary for different levels or groups in the organization.³

- The bosses need to understand the bigger strategic issues, the options, and the critical decision points.

- The planners and architects need to understand the uses of the technology, the market and trends, and very importantly -- the standards.

- The doers or users need to know what it means to them, how to get ready, the part they play, and the training plan.

Strategic education is a process, and if it is working it never ends. It is a continuous cycle. The process takes the "street smart" people and the lessons learned and articulates them to the organization so the "stories" can continue... and on and on!

TACTICAL TRAINING:

As tactics flow out of strategy, so tactical training must follow, strategic education. In the ready, fire, aim concept, the tactical training is one of the aiming forces. It starts as soon as the decision is made to fire. It is the "how to do it" part. In the telecommunications business, tactical training is not only training the technicians on how to install and maintain systems and networks, it is training the users on their use. Important

here is to do training early, not after the weapon misses the target.

Just as training is one basic responsibility of command, it is the technical leader's responsibility to insure people get innovative education. Continuous learning is essential in this business of rapid change.

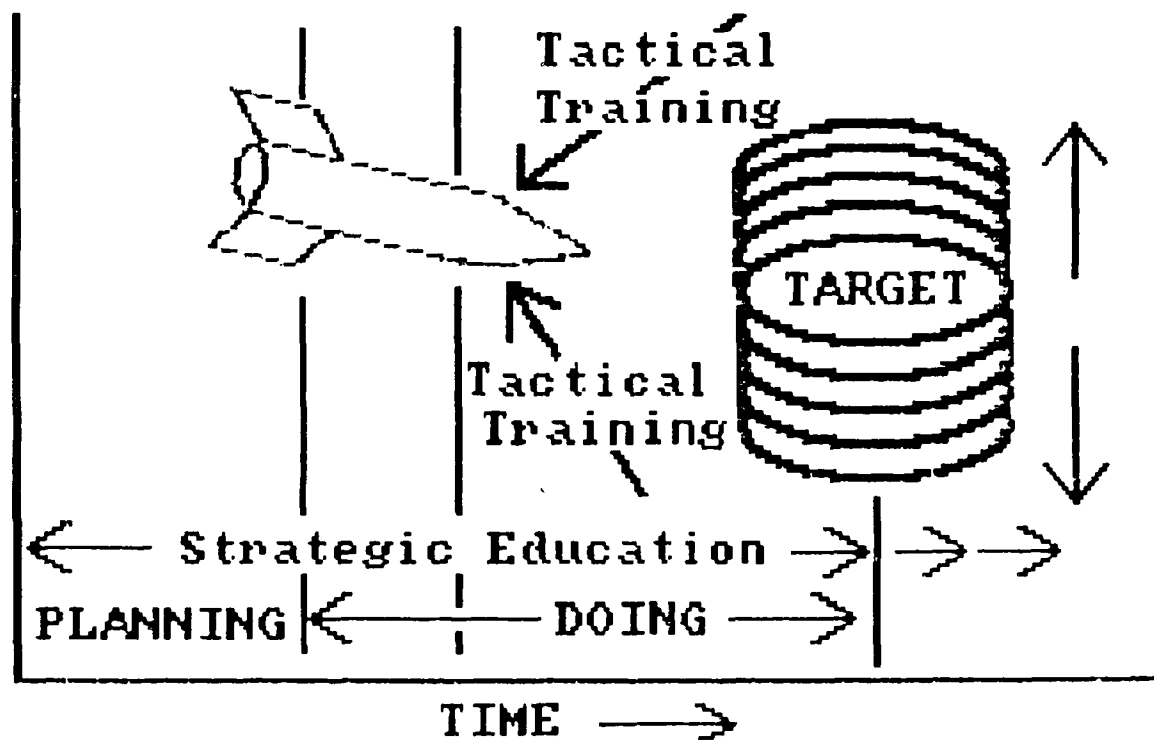
The technical worker or technician in today's telecommunications environment needs to know more than a narrowly specialized skill area. The networks and information systems today all have microprocessor-based systems which interact and "play" to form a whole. The "smarts" is no longer at one place, it is spread everywhere through the system. This presents both challenges and possibilities. The differences among the telephone, the computer, and even the radio are fading fast. All will become microprocessor-based pieces of the bigger telecommunications system.

Attack the boundaries! Good combat leaders know the best place to attack is at the boundaries between armies, because these are often the weakest points. Napoleon was a master at this.

Successful technical leaders will be those who create an innovative atmosphere of learning among technicians, an atmosphere that breaks down the traditional specialty barriers and allows technical expertise to grow outward based on mission needs and individual strengths and desires.

The most successful telecommunications organization, in peacetime or war, will be one where boundaries are not fixed, but merged. In other words, whether in voice, data, or radio... "bits are bits!"

Figure 5.1 shows the relationships of strategic education and tactical training to the ready, fire, aim model. Strategic education is ongoing and continuous, whereas tactical training has a specific short-term purpose and contributes to the aiming process. Strategic training is getting ready for the battle. Tactical training is putting the bombs on target.



READY, FIRE, AIM

Figure 5.1

CHAPTER 6

THE INTEGRATED ORGANIZATION CENTRALIZATION WITH DECENTRALIZATION

The computer will smash the pyramid: We created the hierarchical, pyramidal, managerial system because we needed it to keep track of people and things people did; with the computer to keep track, we can restructure our institutions horizontally.

Networks restructure the power and communications within an organization from horizontal to vertical.

-- MEGATRENDS

For the military, has this change already begun, or will it happen at some future point in time? It's already happening in the more innovative organizations, and it will spread quickly. The military telecommunications leaders who anticipate this fundamental change and take a proactive approach now will be the heroes of the future. Why are our highly-centralized, layered structures ripe for change? For three reasons:

- It is not the way we will fight.
- Today's knowledge workers (combat troops) need responsibility and accountability. Layering and centralization fogs accountability and responsibility.
- Computer and telecommunications networking technologies collapse the information float, from the "pointed end of the spear" to the top, thus eliminating the need for intermediate reporting and controlling levels.

What is the combat organization chart in the foxhole? It's something akin to the captain in charge, with everyone else in the foxhole under him. In combat, the goal is clear. All unnecessary overhead quickly goes away due to two factors: the need for rapid information flow, and the need for basic survival. Everyone knows what to do, and the entire foxhole gets immediate feedback if any changes need to be made.

The pyramid will be replaced by the integrated, networked organization. Technology is affecting today's organization at a faster pace than many realize. A prevalent complaint today from senior leaders of dynamic military organizations is that they're almost drowning in information. Paperwork, issues of the moment, phone calls, and meetings, and briefings demand so much of one's time in a day that there's no time for strategic planning or thinking.

THE INFORMATION & PAPERWORK MILL

How did things get this way, and where are we headed? The bar chart in figure 6.1 shows availability of those major information technologies which have a direct impact on how our organizations have functioned over the past 100 years.

It all started over 100 years ago when the telegraph and telephone gave man the ability to transfer information over

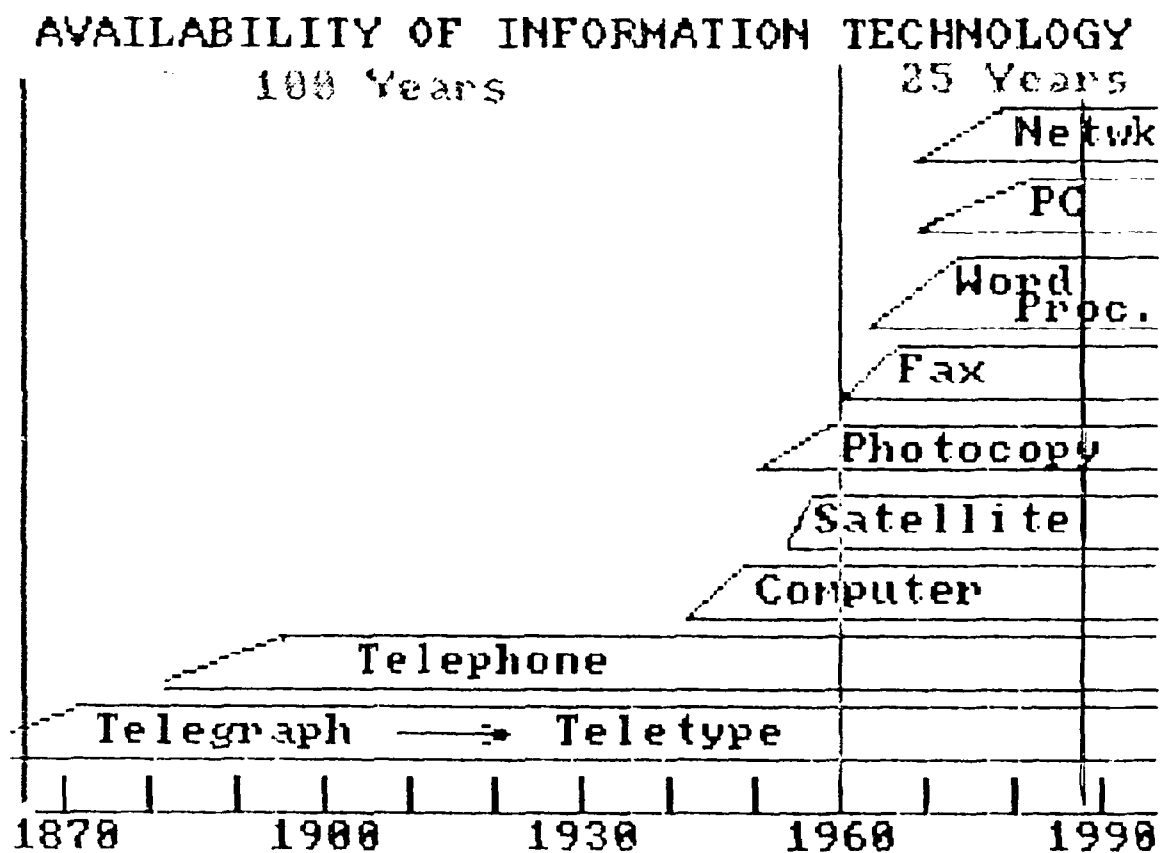


Figure 6.1

long distances in real time. The telegraph turned into the teletype, and radio complemented the telephone as another means for voice communications. And, the next hundred years were a world of voice and paper communications. Over that time, our organizational structures grew up to support a military commerce system whereby the flow of information was paper from typewriters, and teletypes, and voice from phones and radio. Organizational structures and staffs came to exist for the purposes of synthesizing information so it could be presented to decision makers at the time it was needed and in whatever format required. Moving information was a labor-intensive process, but it was relatively easy to control the flow of information to the decision maker. the information float time was relatively slow, and people in the organization could control the pace at which information moved through the organization.

Over a hundred or more years entire organizational cultures developed around the art of mastering information flow. The gatekeepers were able to control the information flow. The secretary controlled phone calls to the boss. The paperwork moved only at the speed with which people could write and type. The facsimile began to appear on the scene in the 60s, but only for highly specialized applications.

Then came a technological development that was the most phenomenal mover of paper information since the Gutenberg printing press -- the photocopy machine. The late 60s and

70s saw the photocopier machine use grow at rates that were only surpassed by the amounts of paper that organizations were able to produce on it. The paper information proliferated, and the staff decision packages got bigger.

Next, the late 70s and early 80s gave us the word processor. It became possible for anyone to type final quality documents, make any changes as often as needed without retyping the whole thing, and print as many copies as desired. And the paper mill grew more!

Now, in less than five years, the microcomputer has permeated our organizations. And what is it used for in most cases? To produce more paper! Why? Because the organizational culture that we've developed over the last hundred years still knows how to produce and move paper best, that is still the "comfort zone" of the organizational culture. But things are changing fast. Paper will be replaced by the network, while remnants of the 100 year-old organizational information culture will have to be dealt with.

THE NETWORKED INFORMATION-BASED ORGANIZATION

The move from the word processor to the microprocessor is a change from the confines of the desk to the rest of the organization, and to the world. It won't take long for the organizational culture to adapt to this change and discover

the value of the networked microcomputer. As the organization reaches a critical mass of computing power on desks, its users have a greater need to share files and communicate. In the more innovative organizations it has already happened.

So much of telecommunications is nothing but watching and understanding how people interact and exchange information to reach objectives. The forward thinking telecommunications leaders are those planning and building the networks for 1990 now. The networking battlefield is rich in small targets ready for quick ready, fire, aiming. These small targets are the ones that can be shot quickly to get smarter on what exactly the overall vision of the 90s should be.

Today's telecommunications leaders must go beyond technology to understand and facilitate the networking of the future. They must understand where the organization is going, and maybe help get it there faster.

Peter Drucker talks about the organization of the future, the "information-based" organization that is rapidly becoming reality -- "a structure where information serves as the axis and as the central structural support."¹ He talks about companies that reshape their management structures around the information flow. An information-based structure is flat, since the levels of coordination are eliminated. Only the doer levels remain. Relate this to the military

organizations of today. Would the coordination levels remain in the intensity of combat?

Drucker provides new thinking about the principle of "span of control." His premise is that that span of control is not applicable to the information-based organization. He says:²

I call it the span of communications: The number of people reporting to the boss is limited only by the subordinates' willingness to take responsibility for their own communications and relationships, upward, sideways, and downward. "Control," it turns out is the ability to obtain information. And an information system provides that in depth, and with greater speed and accuracy than reporting to the boss can possibly do. The information-based organization does not actually require advanced "information technology." All it requires is willingness to ask, Who requires what information, when and where?

The point that Drucker goes on to make is that the information-based organization requires more "soloists" with more and different specializations in all areas, and that information rather than authority enable them to support each other. That's not any different than the troops in the foxhole, or the M-1 tank crew.

The traditional military organization is modeled after command authority. It tends to focus on a top-down approach to doing things. That might have worked in the Napoleonic days when the masses were all equal and the focus was on quantity and mass. But in today's intense warfare where smart weapons and quality is more important than quantity, will it work? Drucker compares the information-based

organization to the top-down organization:³

Information-based organization rests on responsibility. The flow is circular from the bottom up and then down again. The information based system can function only if each individual and each unit accepts responsibility: for their goals and their priorities, for their relationships, and for their communications... The information-based organization thus requires high-discipline. This in turn makes possible fast decisions and quick response. It permits both great flexibility and considerable diversity.

This sounds like the battlefield of today. The military organization has always been an information-based organization. What's changing at a faster and faster rate today is the introduction of networking and processing power. In fact, for the first time we are reaching a point where these added capabilities of computing and networking, if overlaid smartly within the organization, can provide the real-time intelligence sensor information directly to the target killer at the pointed end of the spear.

In traditional organizations and early armies everyone did the same job and brute strength was the main contribution. Whatever knowledge that existed was concentrated at the top. Today's organization needs individual knowledge and skills. What each person knows is what matters, not what each person doesn't know.⁴ As the accuracy revolution continues and we rely more and more on smart, expensive weapons and mission systems, the demand grows for more and more knowledge at the front line, and through the support structure.

From an information flow standpoint, the peacetime organization should not differ from the combat organization. What computers and networking demand is a fundamental understanding of what people really do. Those levels that merely coordinate will no longer be needed. They will be replaced by the networked organization. Those in the network will have special knowledge and skills to contribute. This is the integrated organization.

What does this mean to the telecommunications leader?

More and more, we will see large organizational layers disappear and be replaced by computers and communications links.² It is already happening in private industry. The first people to get laid off, even in the large well-established companies, are the middle managers. The military never has to balance the forces of modernization with those of unemployment; we never have too many workers. The corporate organization faces the challenge of what to do with too many people, while the military services of today are short of people. And the military needs the extra manpower at the bottom, or the pointed end of the spear to operate the mission systems we fielded in the 1980s. Where will these shortages come from? The answer: From the middle layers. We can and will end up restructuring through networking.

One caution against naive optimism. Networking and computers cannot fix an organization that is not organized

right to start with. Information and telecommunications technology will only help the organization that is doing the right thing in the first place. The most likely candidates for new networking and telecommunications capabilities are organizations or groups that are new or those that have recently reorganized. In these organizations, culture and boundaries of responsibility are either in a state of disarray, or they are not yet firmly established. In these situations, people are more apt to do what seems like the right thing than what an established organizational procedure or culture tells them to do. Here the telecommunications leader must sometimes communicate forcibly what technology can, and cannot contribute, and then jump in and help make things happen.

Thus, the telecommunications warrior and the telecommunications organization will play vital roles in the integrated military organization of the future. The organizational network will have few geographical boundaries, it will be world-wide. And, like the rest of the military the telecommunications organization of the future will have an increasing number of small, self-sufficient expert groups throughout the organization, close to, and with, the operating units. The telecommunications structure supporting the integrated, networked organization will be streamlined and decentralized, like the organization it supports.

CENTRALIZATION WITH DECENTRALIZATION

Peter Keen emphasizes that telecommunications eliminates the dichotomy that exists between centralization and decentralization. Telecommunications allows decentralization with centralization.

The centralized organization exists primarily to have order in the decision making process, and uniformity in action. The military organization has become the classic example of the centralized organization. As our military systems and the world increased in complexity, organizational groups with specialized skills and knowledge grew in numbers and size. Over time, the natural tendency was to add layers and centralize even more in an attempt to control and manage diversity.

In later years, the push has been toward decentralization, toward pushing responsibility back down the organizational chain where it belongs. Successes with decentralization, like the Air Force Tactical Air Command, show that responsibility can be shifted to make an organization a bottoms-up rather than a top-down organization. All this has created the right environment for organizational change, and will help the job of the telecommunications leader.

The integrated, networked organization is a circle, not a pyramid. Figure 6.2 is an example. Like groups are linked across geographical boundaries making distances of little importance in the overall scheme. In the figure, the boxes can either be persons within an organization or entire organizations. The circles show how information actually flows, both laterally and up and down the organization. The telecommunications leader should see circles, not pyramids.

INTEGRATE THE TELECOMMUNICATIONS UNIT NOW!

Don't wait! Integrate the telecommunications organization now. Use the ready, fire aim model and experiment and innovate early. Eliminate unnecessary layers in the telecommunications organization, and focus the effort on networking in order to provide required combat and peacetime support.

INTEGRATED-NETWORKED

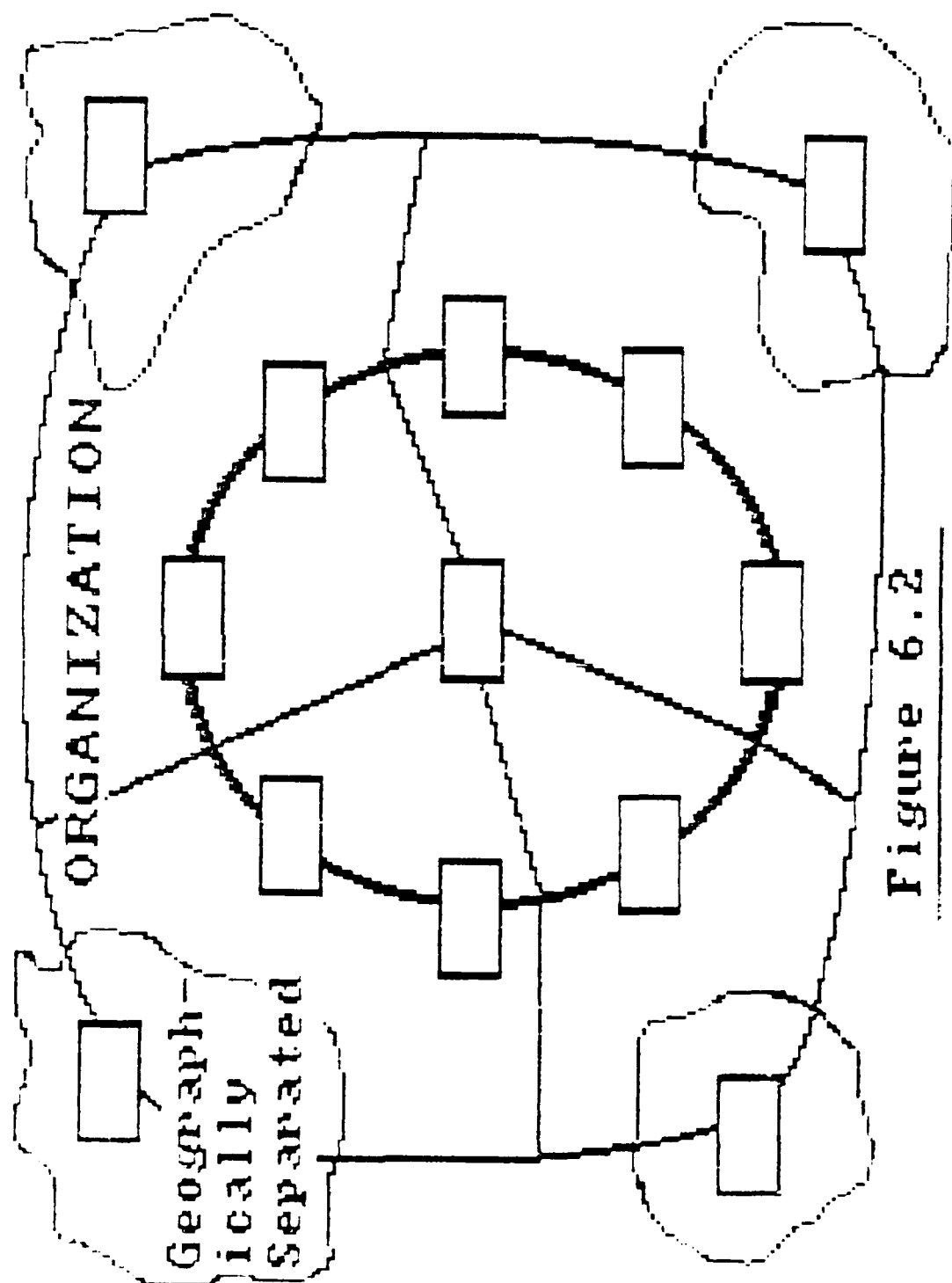


Figure 6.2

The telecommunications organization that has a vision established and is doing active targeting and aiming will understand and support any efforts to integrate and network the organization. Begin by networking the telecommunications organization together as soon as possible. The networked telecommunications organization serves three important purposes. First, and most importantly, you'll learn lessons quickly that can be applied throughout the organization. Second, it creates an effective, responsive organization, helping to build a culture that supports experimentation and change. Finally, a networked, integrated telecommunications organization is an example for the rest of the organization to follow.

Start setting a vision, firing, and getting the rest of the organization aiming as soon as soon as you are confident that your telecommunications organization is ready, but don't wait too long.

CHAPTER 7

THE ADVANCED TECHNOLOGY PEOPLE -- INTEL ON THE FUTURE

... the wisest companies will set in motion early planning methodologies that allow them either to quantify the intangible benefits of a technology's potential, or to commit to it on the basis of intuitive evidence.

-- John Gantz

Trying to keep up with telecommunications technology is like trying to change the tires on a moving car.

-- Anonymous

The link between the art of the possible, and the reality of the present is a fast moving train. Every telecommunications organization needs people and an institutionalized process that are dedicated to painting that moving train.

Designate a person or group responsible for tracking emerging technology and making recommendations to management. Today, the pace of change is too rapid to wait, either for solutions from above, or for requests and demands from users. The commercial telecommunications battlefield is rich with targets, lessons, and ongoing battles. What is needed is good intelligence on the latest battle: the players, the winners, the losers, and the latest directions. From that intelligence will come smart decisions on what targets the military telecommunications leader and the organization should aim toward.

This job is not something to be accomplished on a part-time "hit or miss" basis, it has to be a proactive, full-time responsibility. The ready, fire, aim model relies on early commitment, followed by disciplined aiming toward the vision. In a process like this, it is absolutely essential to keep current and make necessary adjustments quickly. Having a dedicated person or group doing this helps the telecommunications organization in three ways: the customer will get better and quicker service, the organization will enhance its ability to deal with change, and people will be able to keep up with technology.

The responsibilities of such an internal research group must be tailored to fit the particular needs of the organization. But, as a minimum they should include:

- Following technology developments
- Tracking lessons learned by others
- Doing market research
- Examining new technologies
- Tracking standards
- Providing feedback to vendors on user needs

These are the people attending the conferences and trade shows, and using the services of the technology research contract I mentioned earlier. These are the "street smarts"

people, the intel folks. These people are the watchers of the industry wars. These are the people articulating needs to vendors and causing new products to come to the marketplace.

How many people do you need doing this job, and what type of people should they be? Probably the fewer the better. The group might be one person, or it could consist of an entire department, branch, or division. It all depends on the size of the telecommunications organization and its mission. In many cases, responsibilities like this fit neatly with the group responsible for planning. What's important is that these people are freed from the day-to-day pressures of direct operational support. They must be free to focus on the future.

The kind of people needed here are not necessarily technical gurus. What is important is that they are able to communicate with the user, and that they understand user needs. More important, they must have the ability to think beyond the "bits and bytes" and synthesize a bigger picture, or vision.

The good technical leader will keep the organization focused on the near term. Near term is anything after today. Long term is anything beyond two years.

PROTOTYPING -- BRIDGING THE POSSIBLE AND THE PRACTICAL

The progressive organizations are those that conceptualize new technologies and applications and work them hard in a test bed or prototype environment. As soon as they have some idea of they need, they know the best way to get smart quickly is to spend a few dollars and try out possible solutions. From there, it becomes much easier to understand how the need can be fulfilled, and to transition quickly into an operational capability. Somewhere, within the organization must rest this formal responsibility for prototyping or "trying things out."

This responsibility might best reside with the advanced technology group, or it might better fit with an operating unit, or even a separate group. The real distinction between the advanced technology group, and the test bed, or prototype group is the type of responsibility -- thinking versus doing. While the technology group is planning, thinking and keeping current, the prototype group is doing and implementing. Ideally, all these responsibilities would, and can be, accomplished by the same unit. Just keep in mind that prototyping or testbedding requires the best technical "bits and bytes" people the organization can find. Mix these folks in with the strategic technical thinkers, and let them go!

It's important to institutionalize the prototyping and put some discipline into the testing and experimenting

process. Have some clear goals for evaluation and establish a time frame to get smart and try something. Focus the efforts on known mission needs, or areas where the requirement is still fuzzy. Don't wait until crisis or war to find out what is needed, try some things now.

One caution. Don't let the prototyping become a process of playing with the latest and greatest. There's not time to play if there's a better way to do it in combat.

Think about how telecommunications should work in a combat situation, and do prototyping and testbedding to simulate that combat scenario. If possible, take prototypes to exercises and deployments. Get as much realistic feedback as possible.

One person with a microcomputer can be a testbed for certain needs.

This entire method of tracking technology and trying it out is essential to success in the ready, fire, aim process. When change is occurring as rapidly as it is today, the user needs to be able to get smart quickly in order to articulate meaningful requirements. It is the telecommunications organization's responsibility to be proactive player in this learning process.

Figure 7.1 shows what I call the generic "knowing what you need" curve. It takes a certain amount of time to know the requirements well enough to be able to articulate them and commit to a solution. The "knowing what you need" curve

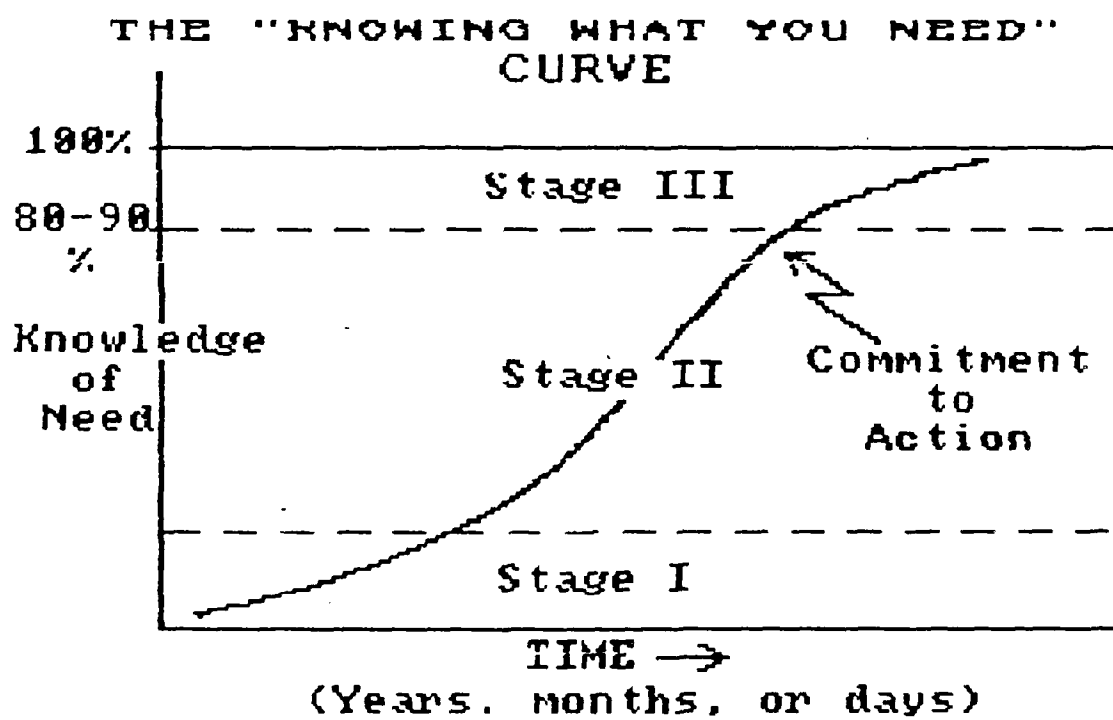


FIGURE 7.1

follows three stages over time.

Stage I starts when a need starts to become obvious to a few thinkers. This stage usually progresses rather slowly as momentum builds and people begin to understand the need for a solution.

Stage II is where things start moving faster. The requirement begins to be understood well enough that people can define its scope. The organizational elements get into agreement on what the need is, and a desire builds for a solution. Stage II ends when at least 80 percent of the need gets defined, and it becomes time to commit to action.

Stage III is the action stage. This curve recognizes that not more than 80 - 90 percent of the need is completely defined by the time one should commit to action to solve the need. I would argue that few if any requirements, especially in telecommunications, are ever 100 percent known at the time that commitment to a solution should occur. The key is to know get to stage three quicker.

Figure 7.1 shows that if these stages are allowed to progress at a normal rate, without any external influences things do not happen quickly. This especially applies in the area of telecommunications and computers if the user does not understand changes in technology, and what solutions are available to fill longstanding needs, or better ways of doing something.

There are three ways to get to stage III, or the point of knowing what you need, and being ready to commit to action:

- Quickly, by way of a crisis or by combat experience.
- Faster, through prototyping and testing.
- At the slower, normal rate as shown above.

Figure 7.2 shows these three ways of getting smart on the curve: the crisis or combat curve, the prototype curve, and the normal curve. The slower rate might be acceptable in an area where change is relatively slow and one can "afford to wait." But, I would argue that is not the luxury one has in a fast moving scenario like today's telecommunications environment.

Refining requirements is "painting the moving train." And there can be a big difference at the margin, especially when you get there quicker. "Letting things happen" won't get you there.

In the ready, fire, aim process, this concept of having people tracking technology and testing concepts is aiming at its best. This "tracking and trying" approach is the intelligence process that makes sure the targeteers, or users, shoot at the right targets. This intelligence shortens the ready phase so the firing can begin.

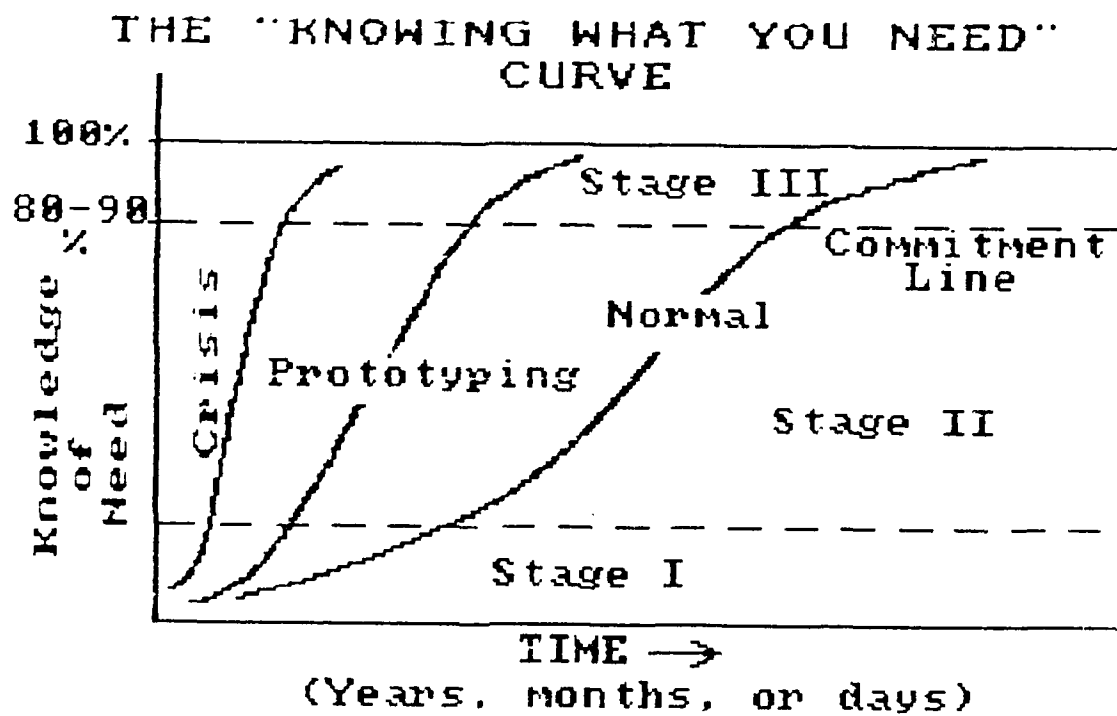


FIGURE 7.2

CHAPTER 8

MANAGING CHANGE

CREATE THE FUTURE -- ONE TARGET AT A TIME

Change is a problem, an opportunity, and a responsibility.

-- Peter Keen

Most people like those changes they have caused to happen, for they are adapting as they create the changes.

-- George Odiorne

Since telecommunications is in the business of collapsing the information float, the name of the game is change. When referring to hitting targets, I emphasized earlier that ready, fire, aim is "doing" rather than "waiting and hoping." This chapter talks about proactive change as a vital part of the ready, fire, aim process.

The concept of ready, fire, aim is to anticipate and make the future happen in increments, rather than waiting and hoping for the "big bang" to happen all at once. Nothing can be more fun and challenging for the technical leader, especially if the organization is learning and its culture is adapting as it moves toward the vision of the future.

The vision and architecture provide the framework for getting to the future. Any vision requires change, and any change introduces uncertainty, or threat. The important

role for the telecommunications warrior is to turn that threat in to an opportunity. The sooner the organization "lives the future," the sooner the threat of change will turn into the opportunity for action. The ready, fire, aim process works by picking some targets to shoot at early, getting people throughout the organization aiming at these targets, and then looking at the results quickly, and with purpose. The result -- getting smarter, quicker! There are any number of ways to do this, depending on the size and scope of the target.

One way is to start a few pilot programs, and use the results from these as milestones for subsequent actions. Another approach might be to assign a few people to experiment with new technologies and recommend future courses of action. Whatever happens, early experimenting and innovation must be the norm. Recognize that things might be slow at the start. And whatever you do, don't force change on the organization overnight based on a few early successes at experimentation. Get some small targets out of the way, and then learn. Unless you're in combat or crisis and have no choice but to act quickly, a more orderly change process will produce far greater results.

FORCED VS. NATURAL CHANGE

In the book *A PASSION FOR EXCELLENCE*, Tom Peters and Nancy Austin talk about the benefits of "natural diffusion" over a process of "forced change." In fact, they say forced

change is the single most important reason why new programs fail. What occurs is that an organization experiments, or innovates and "hits a target" early. Then one of two things can happen.

The staff gets word of the success and mandates its immediate implementation throughout the organization as soon as possible. Everyone then works under pressure to implement the change and two things happen: The "not invented here" syndrome takes over and people naturally resist the change, and failures occur either because of unique circumstances or a host of other factors. The organization spends a lot of time and energy trying to keep things on track, and the end result is some state nowhere near the desired outcome.

Figure 8.1 is redrawn from the book *A PASSION FOR EXCELLENCE*. The graph shows the effects on an organization for forced versus natural change.

The second, and preferred outcome from such an early innovation is a process of "natural diffusion" whereby things start a lot slower, but build at a faster and faster rate as the champions develop within the organization and make the change happen. In the natural diffusion approach, the job of management is coaching and encouragement, one of

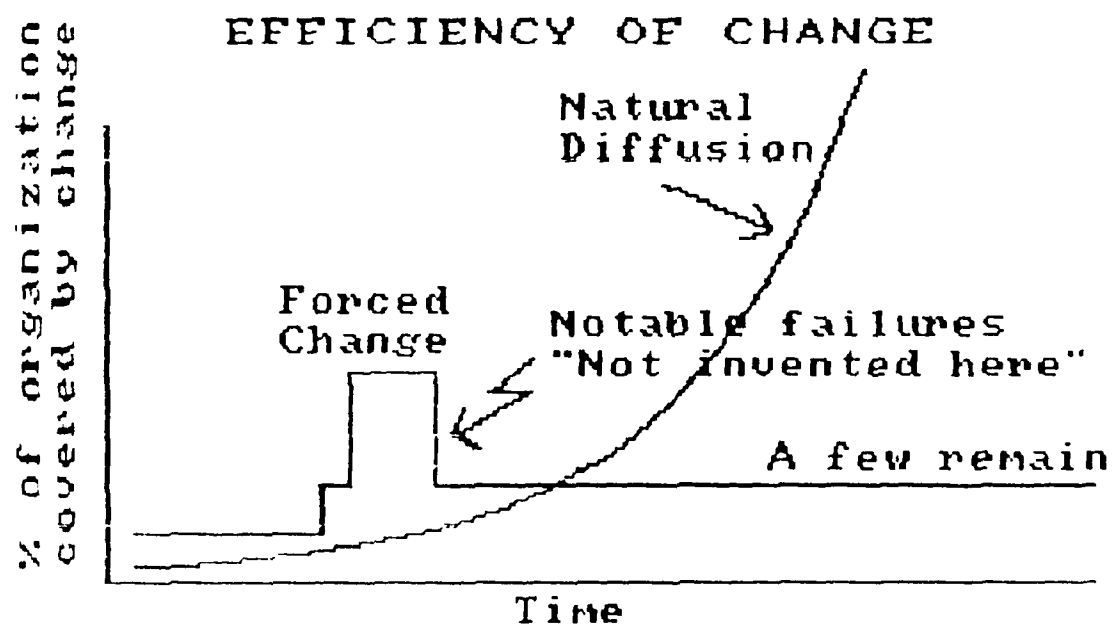


Figure 8.1

Redrawn from "A PASSION FOR EXCELLENCE" by Tom Peters

building increasing commitment over time. Or, as Peter Keen points out, the best way to get radical change is to balance top-down commitment with bottoms-up experimentation. The result of this natural process ends up being more change, quicker.

THE AIMING FORCES OF CHANGE

Change isn't a quick, or one-time fix, it is a continuous process of staying ahead of the curve, and bringing the organization and the culture along with it. It is many diffusion processes all going on at once, all aimed at different targets. How does this fit into the ready, aim, fire concept?

Consider the process of managing change in the ready, fire, aim philosophy as managing the weapon's aiming signals or forces. One job of the telecommunications warrior is to communicate forcibly the rationale for changes and to understand the forces which act, both to keep a desired state of outcome from happening, and to make it happen. In an earlier chapter, I talked about the three organizational forces of the mission, culture, and technology. Look at figure 8.2.

THE AIMING FORCES OF CHANGE

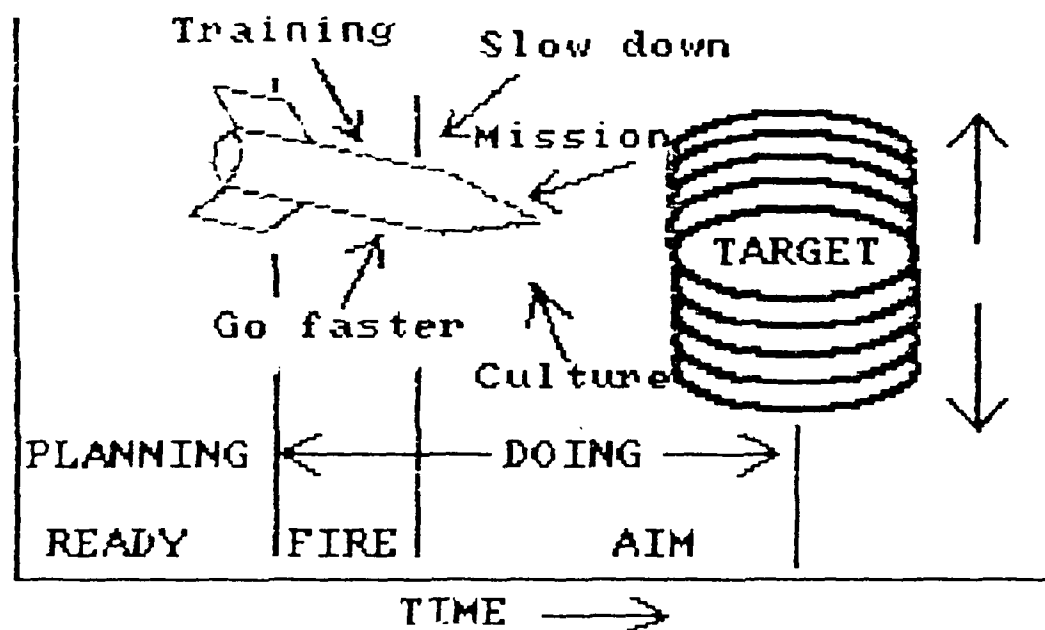


Figure 8.2

AD-A186 679

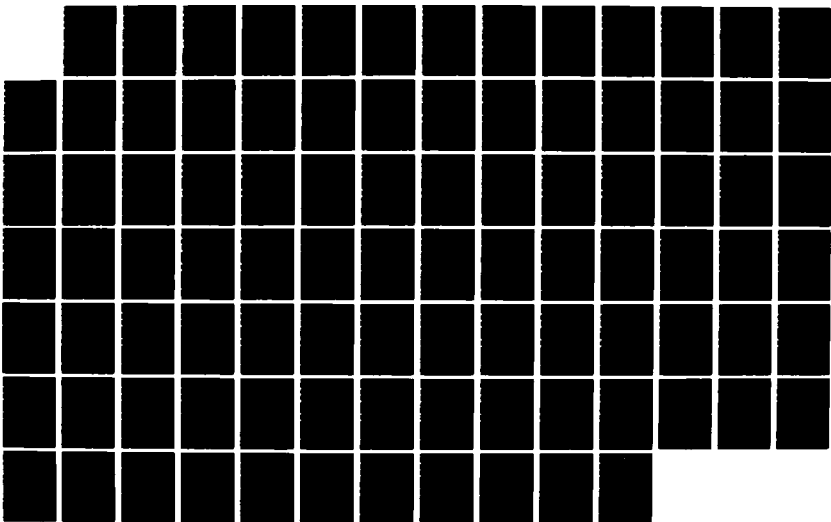
READY FIRE AIM: MANAGING TODAY'S TELECOMMUNICATIONS
TECHNOLOGY FOR TOMORROW'S WAR FIGHTING NEEDS(U) AIR WAR
COLL MAXWELL AFB AL J R OFFER MAY 87 AU-AMC-87-158

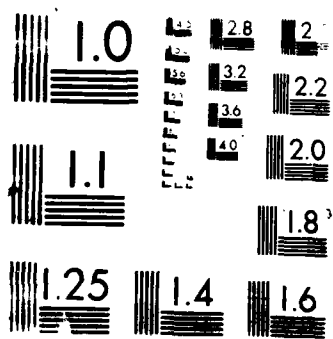
2/2

UNCLASSIFIED

F/G 25/5

NL





Many organizational forces are acting in all directions on the weapon. Some are forcing it to hit the target sooner. Others might force redirection to another target. And still other forces are just acting independently, which if left unchecked or not counterbalanced with another equal and opposite force will cause the weapon to not hit any target. Training can be one of these counterbalancing, aiming forces. The technical leader must be the master wizard over all these forces, the weapon's guidance system, pulling whatever organizational strings necessary at exactly the right time to make sure the weapon hits the target. Thus, the fun and the challenge of managing change.

CHAPTER 9

USERS AND COMPUTERS -- AIMING AT ITS BEST

The people who know the most about any job are the people doing it.

-- John Naisbitt and Patricia Aburdene
RE-INVENTING THE CORPORATION

Never underestimate the power of the frustrated user.

-- Opfer

Find out what the users need, and give it to them. If users don't know what they need, help them decide. There is no reason why technology should complicate someone's job, it should make their job easier. In three sentences, that is the message of this chapter.

Why users and computers? Because users, combined with the power of computers, are causing the most dramatic effects on today's organizational needs and structures. As the level of computers in an organization reaches a critical mass, and as more and more user-friendly software capabilities become available, users' needs will change dramatically. There will be a greater incentive, and need to electronically communicate and exchange information in the form of text and files; and even advancing beyond words and numbers to graphics and pictures. Adding telecommunications capabilities to the organization's user-computer environment does not result in a one-for-one cause and effect relationship.

As mentioned earlier, the results are organic. Just two persons with communicating computers can collapse the information float, not only between themselves, but among other areas of the organization. As people using computers gain telecommunications capabilities, changes begin occurring everywhere throughout the organization. Advance beyond persons to work groups and departments, and the results will be dramatic -- and it won't stop there!

Where are the computers? The computers are everywhere, from the microcomputer in the office to the battlefield computer in the fighter aircraft, tank, or ship.

FROM THE OFFICE TO COMBAT

Likewise, the winners in combat will be those who successfully collapse the battlefield information float through better telecommunications. Think about the effects of linking smart weapons systems together directly in ways we still only conceptualize about today.

Modern weapons systems rely on "smarts" or information to be dispersed all over the battlefield. Success in a future war will depend our ability to get the information distributed to where it's needed, when it's needed. In the intensity of today's expected high-technology war, information will only be of value at a given point in time, and at a certain place.

And the real combat people who need the right information aren't only those sitting in the command posts, they are the fighter pilots, tank commanders, and myriads of combat fighters with smart weapons systems, having the real-time need to access and share information. Combat pilots flying 25 million dollar fighter aircraft, and carrying half million dollar missiles can't afford to wait for voice instructions from headquarters or the ground before making very move. The same is true for the ground combat troops with smart weapons in the high-intensity, high-technology war. Combat troops need more than voice communications, they need smart information links. If we're to realize true productivity in war, we need to move beyond just voice communications to real-time radio linkages of the weapon systems and their computers. And, as we learn how to deploy and use these real time combat computer-to-computer radio links the effects on war fighting will be astonishing. For today's combat troops, any less of a telecommunications capability is not adequate. Fortunately, we haven't yet had to fight any high-tech, high-intensity wars, but Tom Clancy explains what we can expect with the following words:

What modern combat lacks in humanity, it more than makes up for in intensity.¹

The most important users are those at the "pointed end of the spear," those who have to fight the battle. All requirements should start here, and work back through the

war fighting organization. The peacetime telecommunications needs differ from the combat telecommunications needs, but both must complement and support each other.

COMPUTERS CHANGE EVERYTHING

The costs of handling information have not risen over the years, in fact they've probably declined.² The trends for the private sector indicate that a computer will be on every desk by 1990.³ Given the continuing decline in the cost of desktop processing power there's no reason not to expect the same to be the case for military organizations. The computer distributes power from a few positions at the top to users who become responsible for action throughout that organization. There is no precedent for such a radical change as this in an organization. The real capability of all these computers is not in their stand-alone processing power, it is in their untapped capabilities to become communications and networking devices. As users realize the power of the communicating computer, the telecommunications leader better be there to help, or better yet -- be one step ahead.

The more information we have the more we need to be competent thinkers. This is the quandary of the information society: We have an overabundance of data. But we lack the intelligence, the thinking ability with which to sort it all out.⁴

The computer is having, and will continue to have, a profound effect on how we handle information and how we make decisions. People have only begun to understand the decision support power that the computer can provide. The only way to become better thinkers will be to advance the computer beyond a text-only to a visual capability. Let's examine where we are and where we're going with computers.

The tools and capabilities that executives need most involve communications. A Hewlett Packard study found that top executives spend 61 percent of their time in meetings, 25 percent on the telephone and dictating, and 6.5 percent analyzing information from others. Middle managers and professionals spend more time creating documents and gathering and analyzing information, but, all managers still devote a considerable amount of time to meetings and communicating information.² The real power of computing is in communications and networked computers.

Until recently, the desktop computer has done little more than provide advanced record keeping and word processing capabilities. For senior executives, the computer has been of questionable value unless one was an expert typist, or had a need to do spreadsheet analysis. What has been missing is any capability to synthesize information easily, and then use that information to make

decisions. The desktop computer has been a text-only system with little capability to present other types of information in any easy, or user-friendly, manner. The problem is that executives need more than spreadsheets, statistics, and text. They need opinions, facts, and other information from people throughout an organization.

As computers gain in processing capability and software catches up to hardware advancements, the limitations mentioned above will disappear. We are seeing growing acceptance of the icon driven and multitasking software which allows the simultaneous user interaction with text, images and graphics. Why this acceptance? Because for the first time, integrated applications are becoming available on the desktop. People will use computers more when they have two capabilities: meaningful information for decision support, and the freedom to move from one application to another, easily and quickly. Most people are "interrupt driven." They move from one project or thought to another as the needs arise, and then go on to something else when interrupted again.⁶ For the first time, desktop computer software is providing this multi-tasking capability to jump instantly from one application to another. Also, for the first time the desktop computer is breaking beyond the text-only barrier to give picture and graphic capabilities. One picture can be worth a thousand screens of words and numbers.

Finally, the real value of the desktop computer will not be realized until high-speed networking capabilities become readily available to the user. Then the desktop computer will become an information device that is networked into the organizational information structure -- the integrated organization.

Technology is heading to a point where people throughout the organization, regardless of geographic location, will be able to easily transfer words, images, and drawings through networks -- nearly instantaneously -- almost as easily as they can draw the information on a paper. And we know that we'll fight any future war with drawings, images, and pictures, not extensive textual messages.

TODAY'S USERS EXPECT -- AND DESERVE -- MORE

The days of technocrats controlling the flow of technology to the users are over. Today's users need more telecommunications to satisfy diverse requirements; and they expect more, sooner. Telecommunications leaders will be promoted not on how well they study the problem and document the actions needed to get the user a new capability; but on how well they understand the mission needs, get a handle on technology, and put a capability in the hands of the user-- quickly.

Before, the telecommunications organization's motto might have been: "The less I hear from the user the better." Now it's: "How can I better understand the user's needs and work with them to give them a capability -- NOW?"

Also gone are the days of extensive experimenting in the laboratory or the back room, then delivering new capabilities to the user years later. Now, the fielding of new capabilities is a continuous process of change and capability enhancement through user hands-on experimentation and innovation. Today, the technologists need to be close to the users.

Technology no longer changes in slow spurts, it advances in a continuous process that sometimes grows in leaps and bounds, other times it slows down for a while. But technology advances are always evolutionary, and often predictable. The result of this continual evolution presents the telecommunications leader with an ever-changing plate of "mix and match" capabilities.

And the users know this. They are more technologically sophisticated and they understand that constant change is now the norm in telecommunications and information systems. They understand technology and what it will give them. As a result, user expectations are also changing. They know that it's no longer like before where they merely waited for the technologists to deliver new capabilities, all at once.

Users expect some part of that changing telecommunications technology and capability now.

This approach not only requires vision and some idea of a final architecture; it demands a telecommunications organization that stays current with the state-of-the-art and emerging technologies. Get the users involved now in planning the architecture and the vision and help them in defining resulting requirements. It takes a continuous interaction with the users to find the best way to meet the needs by building a capability one target at a time.

Here is where the advanced technology people play a key role, both in tracking emerging capabilities, and in staying close to the users. These people, through their knowledge of what's going on in technology, and their responsibility for testbedding and prototyping, should be the vital link to the user. And the process can't be sporadic, it has to be a one of constant aiming, both by the technologists and by the users. It is a process of being ready, firing, and then doing constant aiming and adjusting to the targets on the battlefield accordingly.

There is no one single telecommunications solution that meets the diverse requirements of today's information environment. It is usually a combination, or "mixing and matching" of components, software, and networks which best satisfies the user needs for information transfer and access. And, many times it's not developing anything new,

but adapting off-the-shelf hardware.

An initial capability might be a few modules of capability, or networks; then, as user needs expand, or as technology develops, capabilities can then be added. This "mix and match" environment builds capabilities incrementally as technologies become available, and as users' needs are better refined and understood.

Never underestimate the power of the frustrated user. This is true for new capabilities, or for users who don't get any new capability at all. Today's military users are more technologically sophisticated, but they shouldn't be expected to have advanced degrees in technical jargon to be able to use new capabilities. User involvement builds user commitment, and puts users higher on the learning curve sooner. Even a naive user should be able to use a new capability on their first try -- this is the true test. If a new capability takes the user out of their "comfort zone," you've probably failed. Early and continuous user involvement will keep this from happening.

Looking at the other side of the coin, no user involvement or giving no new capabilities to users will also be disastrous. Today's users won't wait for the technical gurus. If they perceive that the technical providers are too slow at providing, they might very well do it themselves.

USERS NEED YOU, BUT THEY WON'T WAIT FOR YOU

AT&T was successful at providing universal service under a monopoly for 75 years until advances in technology gave customers more choices than the Bell System was able to provide. Users weren't willing to wait when other choices were available. In the late 1960s certain members of the Bell organization began to realize that it's structure and management procedures were inadequate to respond to accelerating change.⁷ No longer could one organization expect to satisfy all user needs in a diverse world of information technology. Users went with other choices, and the rest became history.

One thing you can't do is control the flow of technology to the users, especially if they are ready and you're not. If users perceive that telecommunications organization can't provide them with capabilities fast enough, they'll begin looking elsewhere. Most of the military telecommunications technology is off-the-shelf, and industry provides many options. Smart users will learn how to take advantage of these options if telecommunications leaders can't fill the needs. It's simply too easy to do. The result might be a happier user sooner, but only for a short while if the users' technical choice was wrong.

On the other hand, it might be best to divest your telecommunications organization from organizational

requirements that you cannot meet if users have a better way of getting a capability. Just be sure of the overall impact on such a decision. If the standards and future architecture are adequately outlined, and the requirements well understood and defined, the users might not need much help from the telecommunications organization. In most cases, I would argue for at least minimal involvement on the part of the telecommunications organization. If nothing else, define architecture and the minimum interface standards that apply. Then, in the future, all networks can easily interface to form the integrated organization.

READY, FIRE, AIM

"The user knows how to do it best." There is a paradox here. The user might know how to do it best, but the telecommunications organization might have the tools or the knowledge to put together better capabilities than users could envision -- capabilities that both meet today's needs, and allow for tomorrow's growth. The key to successful ready, fire, and aiming is to get joint user and telecommunications organizational commitments to action -- not separate commitments.

The whole concept of ready, fire, aim is to implement new capabilities and technologies in stages, and to learn by doing and trying as the organization advances toward a final vision. Users are critical players in this process, not

only at the final implementation stage, but also in the early planning, experimentation, and innovation stages.

The users need to be involved in hitting the early targets and in doing early learning. This is not something to be left to the technocrats. Oftentimes the users just want a Chevrolet, and the technologists try to give them a Cadillac. Worse than that, is the situation where the users don't know exactly what they want while the technologists wait. It is the responsibility of the technical leader to assist users in defining the needs, to include trying out the solutions.

Earlier, I talked about the value of knowing the three organizational forces (technology, mission, and culture), and controlling them as you move the organization toward the vision of the future. The way to succeed in the ready, fire, aim process is to get commitment from the user as early as possible in the ready stage.

Figure 9.1 shows the ready, fire, aim stages with "Level of commitment" on the left axis. Near the top of the left axis is the "action line." Successful target hitting requires a high level of commitment from both the user and the telecommunications organization. This figure shows the way it should work between the provider and the user. The telecommunications people are committed earlier, with users coming on board soon thereafter. No firing, or action takes place until both are committed to action. In fact, the

THE WAY IT SHOULD WORK

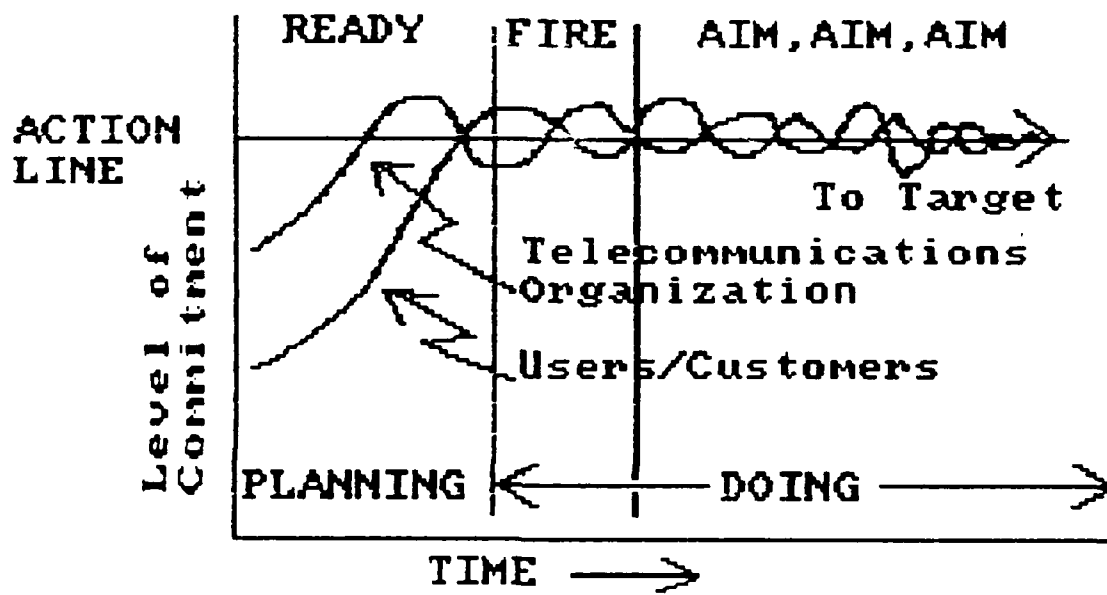


Figure 9.1

users should be the ones doing the firing toward the target. After firing, and as the organization heads toward the target, commitment will waver as other demands and organizational forces affect both the telecommunications organization and the users. It's the job of the technical leader to insure commitment doesn't drop too low on either side without both sides fully aware of possible results.

The earlier that both are committed, the better. If only the telecommunications organization is committed, the effort is probably headed for failure. Likewise, if only the users are committed serious problems may result. By the time you're ready to fire, you've advanced beyond the planning stage to the action stage, and if one or the other is not yet committed to action, you'll probably miss the target.

Sometimes it might be better to for both sides drop their commitments and let the weapon go on its way. Maybe, as the organization got smarter, both users and providers found out that a particular target wasn't worth hitting. Many factors could play here. A significant technological development might override the need to hit a previous target. On the other hand, hitting the target might be too risky at the time given a slower than expected rate of technology advance. Knowing when to let the target go, either in battle or in telecommunications, is the mark of a great leader.

CHAPTER 10

ELECTRONIC MAIL -- EVERYTHING STARTS HERE

Managers spend as much as 60 percent of their time communicating with superiors and subordinates. In this context, efforts to automate should concentrate not on the typing efficiency of the secretary, but, instead on the communications flow to and from the executive.

-- John Diebold

Electronic mail, or E-mail, will increase an organization's productivity more than any other implementation of new office technology, and it's easy to do! I dedicate an entire chapter to E-mail because no other technology is so fundamental to the networked, integrated organization.

Why do it? Because electronic mail, or E-mail begins a process of personal networking from which all other networking can, and will, develop. E-mail puts into a personal perspective the concept of the information age. It gives people ready access to the knowledge of others, and allows them to share timely information that paper documents and the telephone never can provide. Most importantly, it collapses the information float in those organizations that are using it, making them competitive and productive. If you're not already into E-mail, your organization is behind.

This chapter explores the value of E-mail, deals with some common perceptions, and gives ways to start quickly and easily -- now!

Until recently, mankind has had to communicate in one of two ways: by voice, or by paper. Voice communication is instantaneous, while paper communication moves at the speed of the carrier, or transportation system. If distance keeps us from communicating face to face, we have three options: communicate by telephone, communicate by paper, or don't communicate at all.

Unfortunately, given the choice of paper or the telephone, one often decides to do neither, and nothing gets communicated.

The telephone, as means of communication, has limitations. First, the speed of information transfer is dependent upon the speed of the spoken words, usually about 50 bits per second in any language. The telephone does not allow very fast information transfer, nor is it very easy to accurately portray visual patterns or pictures. Second, telephone communication, being spoken word only, lacks the ability to be stored and checked later.¹ Last, a major limitation is the "one-sided, caller oriented nature"² of the telephone system.

Today's information technologies move beyond the voice of the telephone to visual information. People acquire 15-20 percent of daily information through what they

hear, and 60-80 percent through what they see.³ Add capabilities like graphics, images, and pictures to the electronic process of information sharing and efficiency takes on a whole new meaning. E-mail is the first step in a process of changing the way people communicate and share information.

In today's complex organizations, people don't make many decisions, or take action alone. The decision process is based upon interactions among many people in the organization. The decision maker relies on knowledge, opinions, and facts provided by others within, and outside, the organization. How do these interactions take place? To date, it has been done mostly by paper or voice. And paper has become the name of the game. We've come to accept the information float that paper gives as the cushion for not having to make decisions or take action quickly, hardly something we can afford in today's combat situations.

How do we move information: voice, or paper? Until the mid-1800s, all communication was limited to the speed of the transportation system -- how fast someone could carry it. Then came the telegraph and telephone, and for the next hundred-plus years, any communication that could not be moved electronically -- that is paper -- moved at the speed of the carrier or transportation system.

To standardize the way that senders presented paper information to receivers we designed forms. And forms

became the culture -- memo forms, request forms, work order forms, suggestion forms, and on and on. The way to get anything done was to put the information on paper, and let the paper move through the transportation system. People were assigned jobs just to move the paper information from sender to receiver.

Today's information systems and networking capabilities make it time to change the organization's culture from one of moving paper and waiting to one of moving information and making things happen.

The solution is to Start somewhere now. Even the smallest beginning will be the catalyst for bigger changes. The solution lies in networking the islands of computing power that now exist in every organization, and even most homes. Just take the simple concept of the in-box and make it electronic. It's not that difficult to do, all it takes is a vision, commitment to that vision by senior leadership, and a willingness to try.

Everyone will agree that the information society is real. Some will say it's developing, and others will say that it's here. What will the networked organization look like and how will it function? Few agree on the ultimate outcome, but all agree that methods of moving and sharing information will change. E-mail bridges a significant gap between the telephone and the paper method of information transfer.

WHAT IS E-MAIL?

E-mail is improved people communication and information sharing. It is a subset of what many call office automation, but it's not office automation in total. E-mail is a way to send electronic messages directly to another person via a computer or terminal keyboard. It's an electronic replacement for the physical "in" and "out" boxes. Incoming mail is stored in the user's electronic in-box until the person logs onto the E-mail system and reads their mail. After reading the message, the reader has several options, some of which might include:

- Reply to the sender
- Forward the message to another person, or organization
- File the message
- Print the message
- Erase the message
- Create a new message, letter, document, etc.

These are minimum capabilities of most E-mail software programs on the market today. The more sophisticated packages allow complete multi-page documents to be handled via the E-mail system. This might sound like a basic description of E-mail, and maybe even a little too basic for the telecommunications leader, but that's exactly what the user needs to understand the value of electronic mail, not a lot of technical terms and descriptions.

E-MAIL CHANGES THE WAY PEOPLE SHARE AND REACT TO INFORMATION

With E-mail, the receiver's access to information and their ability to respond to that information changes.

Voice communication is dependent on the sender and receiver either being face-to-face, or on the network at the same time; not too difficult, given the ubiquity of today's telephone. Voice communication is real-time, the time of communication usually chosen by only one of the participants. There is usually no record copy of the voice communication, and the results are left to the interpretation of each participant.

On the other hand, paper methods of communication have physical constraints. Hardcopy communications require the recipient and the paper to be in the same place at the same time. And it usually takes time, labor, and energy to get the paper to the recipient.

With E-mail, the situation changes. The information to be sent sits in one place -- usually the computer -- waiting for the receiver, or receivers, to read it. Add networking, and the receivers can be anywhere. The important point is that the receivers get the information at the time of their choosing, and they can answer immediately. The "information float" gets collapsed to the degree that the sender and receiver want it to be. Information flow no longer depends on the speed of the

labor-intensive transportation system, from the truck that drives the mail to the staff people acting as gatekeepers.

Whatever information is available in electronic form to the receiver can easily be modified and re-used without retyping.

And E-mail is ubiquitous. It is possible to send an electronic message to all offices or people in an organization at once, and all will have simultaneous access. Just make sure that all in the organization have E-mail addresses, or accounts. Physical constraints keep many from responding or acting on paper information at the same time, but not so for E-mail. Take away the physical constraints of paper, and add synchronization and harmony of action with E-mail.

E-MAIL IS THE FRAMEWORK FOR FUTURE METHODS OF NETWORKING

The way to be ready for the future information technologies is to create an environment now that forms a culture quickly, and then strategically moves that culture toward the future vision.

To understand, let's take a look at the future. Industry predictions say that a terminal, or microcomputer will be on every desk by 1990. Most progressive organizations already have reached that state. Developments in software now allow images, and graphics to be added to textual messages. And, it will soon be easy to draw or

sketch an idea and immediately send it to any other person's terminal.

Get an E-mail culture and network established now and it will provide the foundation for the future vision. Once people start moving information electronically, the rest follows easily.

The telecommunications warrior's job is to help create an organization that moves information the same in peacetime as it will on combat. We won't fight the next war with paper, but we will with the right information.

Starting an organization on E-mail is easy. Like most new technologies, the speed of implementation is directly proportional to the degree of use by the boss. In other words, E-mail should start at the top. The key to successful implementation is to keep it simple and easy to use. Other major points to insure successful E-mail implementation are:

- Commitment to make it work
- Training
- Leaders who use it after it's installed
- Procedures and policies supporting it's use

A good E-mail capability is as ubiquitous as possible. It's no good if people can't talk to those who they need to talk to to get the job done.

Give everyone in the organization access and an account. If you can't right away, at least give an account to each

office. The microcomputer is commonplace in most organizations, and there is no need for a good E-mail system to have a terminal on every desk. Just provide access at a common location.

SOME ELECTRONIC MAIL MYTHS, PERCEPTIONS, AND ANSWERS

1. People, especially senior executives, won't type on a keyboard.

True, maybe a few senior leaders are not yet comfortable using a keyboard, but these numbers are dwindling fast. Most fears of the keyboard use go away as soon as a user understands the value of E-mail and how easy it is to communicate via this method. One only has to be a "hunt and peck" typist to use E-mail. Most E-mail messages and replies are no more than two or three sentences long, and few ever are longer than one computer screen, or 24 lines, especially at the senior manager levels.

2. It's too impersonal. It will keep people behind desks when they should be out with the people.

Just the opposite happens. E-mail complements the both telephone communications and "walking around the organization." It actually allows more time to get out of the office, but yet still do the vital communications necessary to keep things running. The more one uses E-mail, the more people it's possible to come in contact with. The

speed with which a person can deal with E-mail traffic is faster than personal contact. Sure, it's possible to sit behind the E-mail terminal all day not interacting personally with any people in the organization. But, I would argue that E-mail doesn't make one stay behind the desk, it allows one to get away from the desk more. If you stayed away from people before E-mail you'll probably be no better with people after E-mail. At least you will be a better informed recluse.

3. It's too easy to bypass the chain of command.

A good E-mail system should provide a means for anyone to talk to anyone, regardless of rank or position. Peter Drucker reminds us that the information organization works on span of communications, not span of control. In the E-mail network, people must be expected to take responsibility for the information they send upward, downward, and across the organization. If you're absolutely hung up on chain-of-command, then put software controls into the network to keep certain people from talking to each other.

4. E-mail can't work without a terminal at every desk.

More important than terminals are user accounts, or mailboxes on the E-mail system. The main purpose of E-mail is to get more timely and accurate information in the hands

of the person who needs it. This can be accomplished with a terminal on every desk or by equal access to selected terminals. Think hard before denying anyone in the organization a mailbox on the system. Denying E-mail access to someone is a signal to them that they're not important.

5. All The people I need to talk to are not on E-mail.

This is probably true. Unfortunately, it will be quite a few years before E-mail is widespread and as easy to use as the telephone. It has to start somewhere, and E-mail will start as islands, or pockets of activity. The key is to build a core network quickly. Then, expand outward connecting this core to other E-mail islands as soon as possible.

6. People in the same office should not be sending computer messages to each other.

Again, this is not true. The number one time wasters in any office environment are the telephone and interruptions. Productivity through better information sharing is critical to today's work environment. People need to interact verbally if they work in the same office, but they also need more fluid and flexible methods of sharing information than just paper and the telephone. They also need quiet time to just be able to think and synthesize ideas and concepts.

Electronic mail provides that a vital link consistent

with the capabilities of today's technology. E-mail adds a synchronization capability to the office environment that no amount of memo writing and verbal communication can achieve.

Paperwork goes down while productivity goes up. Also, consider the enhanced productivity E-mail can provide for those travelling away from the office with such capabilities as laptop computers.

7. There are no standards.

It's true, there are not yet worldwide standards for document or message transfer among varying E-mail software packages. This is no reason to wait. What is important is to get people understanding and using this new medium and getting comfortable with it. International standards have been agreed upon, and it won't be that long before the translation software is available to send and receive mail from any other system worldwide. Get E-mail up and running now, and worry about the interconnects later -- take one target at a time!

8. There are too many security concerns in a system like E-mail.

The positives outweigh the negatives. Compared to paper, E-mail is a more private form of communication, going directly from sender to receiver. Some organizations might need a completely secured E-mail system to handle classified

information. Procedures and hardware exist to insure remote dial-up access security, and future embedded encryption capabilities should enable easy encryption of network and dial-up access links.

9. A good E-mail capability is hard to implement within an organization.

The biggest problem is getting senior level management to try and use E-mail. Once that happens, everything else is easy. Remember, E-mail is the framework for all other electronic networking, and information technologies of the future. The job of the telecommunications leader is to sell and convince top management on the benefits of E-mail. It doesn't take much pushing once the initial inertia is overcome and senior leaders start using it. The biggest task after that will be expanding the network to "cover the world."

10. E-mail changes the culture of the organization.

This is true. Any capability that changes the very way that people interact and share information will surely change the organizational culture.

E-mail culture is different. People write and express themselves more openly and directly when using E-mail. The spontaneous nature of E-mail oftentimes results in more emotion, feelings, frustrations, and probably honesty

being transmitted than would normally occur in other forms of written communication. There is more informality in electronic communication.

The electronic culture speeds up the action cycle in an organization. Things get done faster. It's easier to synchronize an organization's actions toward a common goal.

And, an organization on E-mail is much better at responding to unplanned events and crises.

THE FOUR PHASES OF E-MAIL ADOPTION

Dave Bezaire of Compuserve says that organizations implementing E-mail experience four phases of change:⁴

- Phase 1: Simple acceptance of the medium. Some people get excited about the new medium, while others feel threatened. It takes time for users to adjust.
- Phase 2: Becoming comfortable with electronic communications. The more people use E-mail, the more they feel at ease and understand the value it provides.
- Phase 3: Creativity. After people become comfortable with E-mail they begin to use it for other modes of communication. For example, there is more of a tendency to ask opinions. Communications broadens to cover more people when the word needs to get spread.
- Phase 4: The organization comes to rely on E-mail. Communication via E-mail replaces paper and the telephone on a wider scale. In this stage, E-mail is accepted as a part

of the culture of the organization. People begin to see the need to expand the E-mail network outward.

MAKING IT HAPPEN -- READY, FIRE, AIM

All organizations are ready for the increased capability that E-mail gives. It is the job of the telecommunications warrior to make that capability happen.

Don't wait for top management or higher headquarters to direct it; it won't happen. Recognize that E-mail is the foundation for the infrastructure and organizational culture that learns to share information better through advanced technology and begin mobilizing the organization for action.

Once E-mail is accepted and operating as a new medium and a new culture throughout the organization it will be much easier to introduce other technologies. Make the first target textual electronic mail, and from there start on the other targets of graphics, image processing, and other visual technologies. Use micro, mini, or mainframe computer off-the-shelf software packages for E-mail. Don't develop unique software.

Most organizations have an abundance of microcomputers just waiting for the communications software and communications links to make them vital weapons in the organizational information system. Work it one target at a time. The first target might be to connect small work groups together via local area networks and get these groups

communicating electronically. From there, start networking the work group islands together to form an organizational network. At the same time, begin the process of linking the organization to outside organizations like higher headquarters and geographically separated units. Use the Defense Data Network links wherever possible. Force E-mail outward and upward.

This a more detailed "how to do it" chapter than the others because electronic mail is a vital capability. E-mail must become a part of the organization's culture before the telecommunications warrior can expect much success in other areas of networking. E-mail offers many targets ... start firing now!

CHAPTER 11

STANDARDS AND POLICIES -- YOU CAN GET THERE FROM HERE

Standards define the interfaces between facilities, not the facilities themselves.

There is no one right policy, but there must be some policy.

-- Peter Keen

In an area growing more complex and fluid by the day, some structure is needed, and standards provide that structure. During the 100 or so years of analog, standards weren't that critical -- voice was voice. Sure, we had to agree on the ringing voltages, bandwidths, and other things like signaling schemes; but when the pace of change was slow, the standards were adequate for years, or decades, and things seemed easier.

When there were only two ways to communicate -- voice or teletype -- the interfaces were easy. Then, along came the microelectronic and computer revolution. Where before it was only people talking to people, now it became computers talking to computers. And everything changed. The new challenge became not how to get people talking, but how to interface things that talk. The need for standards started growing as fast as the microchips themselves.

The paradox is that standards can be both a help and a hindrance to progress in the telecommunications business.

Standards help by making it easier for all users to "connect." On the other hand, since standards are nothing but consensus, their absence can cause chaos and delay. Those organizations on the leading edge where no standards are yet established are faced with two options: Go with what they think is prudent given the expected direction, or be forced to wait until consensus or standards emerge before committing to action.

The question is how much structure is needed? And the issue is how long do we wait for standards that have not yet developed?

The ready, fire, aim process won't work in an environment without structure. Too much standardization stifles innovation, and too little standardization causes chaos. The key in the ready, fire, aim process is to maintain a balance between these factors. The very premise of ready, fire, aim is to get on the leading edge of technology to influence change in your favor. Being on this leading edge often poses a dilemma. One cannot afford to sit on the sidelines and wait, yet being on this leading edge often means charting unsailed seas.

Some would say that is the price one has to pay for the privilege of being out ahead. Others would argue that it's best to wait until standards develop. The ready, fire, aim approach says: "Do both." Being out in front enables you to see where technology is heading and what standards

are likely to emerge. Better yet, you might be in a position to influence standards.

Sometimes just getting smart early with small projects of firing and aiming usually puts an organization in an advantageous position compared to those who have done nothing. The ready, fire, aim organization will be knowledgeable on expected outcomes of new capabilities; oftentimes before a standard even develops. They can then afford to either experiment further on a small scale, or "sit and wait," knowing full well that the expected results will be worth the wait. Being on this leading edge, especially on a small scale, offers more benefits than risks.

The key is not to get the organization "boxed into a corner" with no sight of any easy way out. Technology is headed toward "meeting points" where software and smart processors will provide the interfaces to common standards. The challenge is to be there waiting at these meeting points -- ready to connect.

An example where it is possible to do this is with electronic mail. Here, international standards are on the horizon -- not years, but months away. You can implement E-mail within your entire organization, yet be ready to interconnect with others running totally different E-mail systems as soon as the international standards are available. A worldwide E-mail standard is emerging similar

to the way that a Group III facsimile standard developed. Only, where facsimile standards took decades to develop, the worldwide E-mail standard has evolved in only a couple of years, thanks to the collapse of the information float. Today, no competitive facsimile maker in the world makes unit that doesn't speak the international standard, yet no two machines have the same features and capabilities. Electronic mail will be no different, except that things will happen faster.

The same is true for all other areas of networking and telecommunications. Where standards used to develop over years, now that period is often measured in months. Do early firing and aiming and you'll be ready for the standard.

HOW MUCH IS ENOUGH?

Be results oriented. What's important is who can talk to who, not how many have the same equipment.

If the goal is to integrate the entire organization, then obviously you need standards. However, what's needed are standards for interfaces, not standards for hardware. The result is an environment where users are free to choose the equipment that best meets their needs as long as certain interfaces are met. The user needs to be able to use any

vendor's equipment, transparently. The key is to pick off the shelf equipment and stick to the emerging global standards.

The photocopy machine is an excellent example of how the right standards develop over time. Each photocopy machine vendor produces a machine with whatever features they can add that will sell more machines. Only two minimum standards apply, and they apply to all machines. These are the sizes of the paper trays -- 8 1/2 X 11, and 11 X 14 inches. Another example is the computer printer. You basically get two choices, serial or parallel, but the different printer manufacturers offer a myriad of features and price/performance choices.

OFF-THE-SHELF EQUIPMENT AND OFF-THE-SHELF STANDARDS

Don't agree to accept any unique standards, there is no reason to do that today. In fact, one could make the case that to do so is a sure route to failure. Standards are coming off the shelf, and they're coming fast. Standards develop through consensus, but competition runs the marketplace. As users become smarter, and choices multiply, users often expect to have their cake and eat it too. They want the flexibility to interface with the freedom to choose special features. The vendors that survive will be those that provide common standards, yet meet the unique needs of users through individual product capabilities.

As the information float collapses, and the user needs for networking continue, the standards will develop faster. The basic framework for most of the data transport and communications networking standards are already in place. The only actions left are to get international agreement on detailed interface protocols. As the market drives the need and the information float collapses, the standards will surface faster and faster.

You can see standards coming on the horizon. And those developing standards are a great barometer. This doesn't mean you should delay prototyping and molding new technology just because standards don't yet exist. What it means is to be on the lookout for the issues and the expected standards. Being there early will help your organization understand the issues and give a clearer picture of what minimum standards are needed. When you're on the leading edge, be results oriented. The methodology will take care of itself as soon as you commit to the technology.

The road to the future is paved with international standards. You might want to deviate slightly to get some capability sooner, but don't go far from the main road or you might have a rough time finding the way back.

YOU HAVE A RESPONSIBILITY TO PUSH STANDARDS

The post-divestiture proliferation of vendor specific standards is giving way to a global consensus on interfaces. However, Don't expect industry agree on standards without constant nudging from the user. The big players in industry often aren't easily motivated to migrate toward common standards if it might mean a loss of product sales to the competition. They might very well have more to gain by hooking users onto proprietary interfaces. One of the jobs your advanced technology group can do is articulate to industry the need for common interface standards.

Vendors are usually reluctant to do their own interoperability tests, especially if the specification for the standards are incomplete. Here is where your advanced technology group can play a big role. Prototype early products and capabilities and test the interfaces. Then, force vendors to resolve any incompatibilities... it works. Hold vendors responsible for proving their interfaces meet the standards that you as a user specified and expect.

POLICY FOR WHAT?

Ready, fire, aim is a policy... a policy for keeping up with today's technology options, while incrementally moving toward a vision of the future. Earlier I talked about meeting points. These are the places where the islands of individual networks connect or meet at a standard. A policy

might be needed to define what these meeting points are and where they are located. The organization needs a policy defining what interfaces will be supported to connect islands or clusters of users. Once those interfaces are defined, users are on their own if they choose others.

MANAGING STANDARDS

In any organization, the telecommunications business has under some framework that allows change and encourages innovation. This is the job of the telecommunications leader. If the ready, fire, aim process is working then the resulting teamwork and information sharing among all key players in the organization will obviate the need for many directed policy and standards.

Watch the standards. They are good targets. If they'll get you there shoot at them. Your advanced technology group is a valuable asset for tracking the progress of standards. The time for standards to develop is going from years to months. You cannot afford to wait before committing to action. Commit small through early prototyping, and if the standards aren't yet there force them. Create the islands or clusters of networks and then connect them together.

The battlefield environment might require some unique equipment and standards which are not off-the-shelf, but there is no need for them in the non-ruggedized world. Just make sure the interfaces exist to allow the non-ruggedized part of the military to talk to those doing the fighting.

READY FIRE AIM

The ready, aim, fire process operates on a goal -- what the battlefield (the future architecture) will look like at the end of the day. The better the intelligence available to the telecommunications warrior, the better chance of success in the telecommunications revolution. Know what you want early by being ready. Be ready through early tracking at target shooting. Be ready to hook to right standards as they develop; or better yet, be ready to force the right standards to develop.

CHAPTER 12

COMPETITION AND INDUSTRY -- THE FORCE MULTIPLIERS

It is a user's market, but you need industry more than they need your business. Most of today's telecommunications capabilities are hatched and perfected on the battlefield of the commercial marketplace. The military telecommunications leader needs to track technical developments and new capabilities as they emerge from that battlefield. The ready, fire, aim process is aimed at putting the military telecommunications organization in a better position to react to these non-DOD driven advances in technology. There is no need to develop unique military capabilities for most of our telecommunications needs. The way to learn quickly is to do it with the commercial marketplace. In today's competitive environment, industry reacts to user-driven needs quickly. What is needed is honesty, trust, and a willingness to take reasonable risks together.

In other words... It's the user on one side and the developer on the other. This is the ideal relationship. Get close to the supplier, and don't be timid. Articulate your needs, and be honest; when you don't know for sure tell industry so. Let them help you find out the requirement. They will hit targets right along with you.

The ready, fire, aim process cannot survive or work at all without the developments and products that commercial telecommunications contractors are bringing to the marketplace.

AN EVOLUTIONARY APPROACH -- ONE TARGET AT A TIME

Work with industry and learn together. Oftentimes, the early targets that you might want to hit have already been targeted, and lessons learned in the non-DOD world. The information and networking challenges are no longer unique to the military environment since the private sector has realized the strategic value of information and telecommunications systems.

The challenge is to work with vendors early in the ready stage. You don't have time until to wait until the requirement is validated before starting a dialogue with vendors. Go to vendors early and tell them "what you think you might want." Take a salesman to lunch. Or better yet, have the salesman bring along a product engineer and buy them both lunch. Ask industry how they think they could solve your needs. And then listen.

INDUSTRY IS YOUR PARTNER

Use your advanced technology group to research and seek out vendors, especially those on the leading edge with new, emerging technologies and products. Keeping on the leading

edge of matured technologies is the purpose of the ready, fire, aim process. If your organization gets on that leading edge, industry, will need you as much as you need them. Before long, your organization will become the advanced market research for for industry.

You'll be amazed at what you can convince vendors to invest their own development dollars in if they are convinced that the marketplace is there. Users who understand where technology is going and are willing to experiment with new and emerging products are invaluable to private industry. And then share ideas and be honest with them. Develop relationships that fosters continuous innovation. And most importantly, listen especially attentively when industry says "no." They probably have a good reason.

COMPETITION

Competition is great! The more of it the better in this business. Obviously, competition increases the choices and puts more demands on the telecommunications leaders and users to make the right choices. There are factors which make competition particularly interesting.

Competition collapses the information float even more and shortens product development cycle dramatically. Look at the challenges that AT&T and IBM face today. For years these two giants were monopolies in their fields. IBM

controlled the flow of new computer technology to the customer at the rate that IBM was ready to deliver new technology. The same was true for AT&T and communications services; the users got capabilities, but at the choosing of AT&T and at their price and time schedule.

Then came divestiture, deregulation, and competition. In many cases, users no longer had to wait for new technologies, they had choices waiting for them to choose from. The microprocessor explosion gives any small company the power only the giants had a decade ago. When the user has more choices and capabilities to choose from they will do something. The result is the collapse of the information float and the product development cycle.

Today's military telecommunications leader has a unique opportunity to take advantage of this highly competitive cycle, but only by getting right into the cycle along with industry. Don't expect industry to wait for you, they don't need to. If DOD doesn't need it, someone else will. Go at it small and early. Learn along with industry.

Again, as with standards, being on the leading edge often presents the military telecommunications leader with a dilemma. This leading edge is oftentimes a battlefield on which no one has ever fought. In competition, the very term leading edge usually means there is little, if any, competition. Being there early often means that only one vendor can get you to a target.

Also, these new battlefields can present unique risks. For example, if you're dealing with a radically new capability you probably have no idea how the user will really react, not to mention increased technical risks. None of this should stop you if being on the leading edge fits the organization's vision of the future.

What being on the leading edge with only one vendor means is that you should work in small steps, learning by doing -- hitting a lot of little targets rather than one big one. Grow smarter with that one vendor, but don't commit to too much too early. Telecommunications capability is not like building fighter aircraft, there is usually a commercial application for any telecommunications capability. Sure, there are a few battlefield communication needs that demand special ruggedization and features like anti-jam, but most telecommunications needs for the military are adaptations or exact duplicates of commercial products. If it's really a leading edge capability that's worth it there will be more providers in a short time. But don't wait for all these vendors to materialize if you need to get smart now and there is one vendor that can help you do that.

Encourage competition through all phases of the ready, fire, aim process. Watch very closely any long term, large commitment if there is no other supplier. Other vendors not only drive down the cost and provide a second source, they stimulate better quality and force continuous product

innovation. Experiment with the sole source vendor to stay on the leading edge, but when it's time to jump off that edge make sure you're not alone. In time, other vendors will come along. Then, two things will happen: There will be more choices, and the prices will decrease. If the original leading edge vendor is good they'll still keep the leading edge and you can learn right along with them.

REQUIREMENTS SHOULD BE DYNAMIC

The requirements should change at the pace of the development. There should be a process to review and change specifications at regular intervals, both to take advantage of new technologies, and to adapt to time by adding new capabilities, and deleting those that are no longer required.

The ready, fire, aim process is key to a dynamic requirements process. Industry is usually willing to support prototyping. An early prototype in the hands of the user can do more to define the requirement than months of study efforts.

YOUR CONTRACTING OFFICE -- YOU NEED THEM

You can't get there without a supportive and dynamic contracting process. But remember, those contracting people exist for one main purpose -- to get the government the proper goods and services at a fair and reasonable price.

and to keep you out of jail. They have a job to do, and that job requires methodical procedures and documentation. But there are opportunities here. Look for ways to do creative contracting. The ready, fire, aim process demands it. Look for ways to help your contracting office collapse their information float. Oftentimes, your contracting office might be your first user in need of leading edge information systems and networking technology.

Your contracting office has responsibility to do market research. Your advanced technology group can be a valuable source of market research in support of the contracting, or acquisition, process. You need flexible contracting to be able to do responsive ready, fire, and aiming. No one said it would be easy, but it will be challenging and fun, and very dynamic.

Ready, fire, and aiming works in the contracting business also. It just takes work and an active dialogue between the telecommunications organization and your contracting officer. Keep your contracting officers in the loop. Usually, the biggest problem is a knowledge gap. It takes mutual understanding and teamwork to make things happen fast, but it can be done. Take your contracting officer to lunch, and explain the organization's vision of the future and the part that contracting office will play to attain that vision.

READY, FIRE, AIM

There is no better way to do early firing and aiming than to do it with industry in the competitive battlefield of today's commercial marketplace. Get industry involved in hitting early targets right along with your telecommunications organization and the users. Encourage competition. "Fly off" two, three, or more, products. Learn, be honest with the vendors, and give them feedback. Foster a high degree of mutual trust and a team approach. Industry will do development on their own if they're convinced of the potential market for a product. Oftentimes, those vendors that are willing to take some risks and do internal development will be the contract winners for a final capability.

Do the ready, fire aiming with industry and have your contracting office right along with you. It's the only way to keep up.

CHAPTER 13

MONEY -- IF YOU DON'T GET IT SOMEONE ELSE WILL

In the end, it will all come down to money
-- John Gantz

Money -- there's never enough of it, and everyone perceives the information and telecommunications budgets as growing too rapidly. Sound familiar?

In an environment of competing resources, the only way to get money for telecommunications needs is to make the case, either for improved mission productivity or for subsequent resource savings. The key to being able to do this is to have a firing and aiming process ongoing that gets users smart early, and helps establish a vision and justification for the path to the future.

There are three ways to get money.

Short-term access to money isn't a problem if you have senior management's support for the need. It's even less of a problem if the organization is also supporting you. In any organization there is always some slack available in the budget, and this slack probably varies at times in the fiscal year. Get access to this slack. Even if it is in small amounts it's usually enough to enable some early firing and aiming with small, emerging technology projects. Remember the three organizational force circles of the

technical, mission, and the cultural forces. Get those people in the center supporting a vision. Then, spending money to move toward that vision, even in small steps, will make sense to more of the organization. It sure helps if the budgeting and accounting people are in that center and understand the vision. Take your budget officer to lunch sometime.

The important thing that telecommunications leaders all too often fail to do is to "make the mission case." Active ready, fire, aiming along with heavy user involvement will result in users who know the need and understanding their options without the telecommunications people having to justify the need for money at every step along the way. That's the way it should work.

Another way to get all the money you want is to not do anything until there is a crisis, then everyone sees the need, and the money will flow. Of course, you won't get to spend the money either. Your successor will have it since you will probably have been replaced. Get money through someone else's crisis, but not your own.

The third way to get money, especially for the longer term, is to plan the telecommunications budget according to the architecture or vision of the future. What that future will look like will at best be a judgement based upon educated guesses. Here, the ready, fire, aim process can be a big help. Budget for reasonable planning wedges based on

lessons learned through tracking technology and early firing and aiming. Then, when the time and the money come, fit the wedges to the current needs, with the technology that's available. Ready, fire, aim. Fire is planning the budget wedge, and aiming is spending it.

In reality, getting money is a mix of all three of the above options. The skillful telecommunications leader knows what option applies at any moment. The slack areas and the crises present opportunities for the present, and the long-term planning for money is a must to insure the future.

GET MONEY FROM THE USERS

As telecommunications becomes more and more ubiquitous throughout an organization, the lines of demarcation as to who pays for what will become more and more blurred. The network power and intelligence will get closer to the user. If the need is justified and the users have the money available to spend, then let them fund the capability. That is the benefit of having a close relationship between the telecommunications organization and the users. As long as both the telecommunications organization and the users are aiming toward the target together, who cares who pays? What is important is that the users get the capability.

A few words on reality, or being "street smart" beyond just the technical world. If you have to use acronyms and

talk in bits and bytes, kilohertz and megahertz, then don't expect to get much support from above. The more you build the trust of senior military leadership by talking in terms that they understand, and the more you make the mission case, the easier money will flow in your direction. Successful telecommunication warriors are those who communicate in mission terms, not technical jargon.

Take a first step by thinking combat needs, and work backwards from there. Give regular briefings to senior leadership highlighting the telecommunications mission weaknesses, the status of key projects, and what's in store for the future. Get senior leadership support and commitment to help make the vision happen. Be a salesman!

READY, FIRE, AIM

What can you do today to get started in the ready aim fire process? There is always slack in the current budget, find it and make the mission case why your users need it. Get access to those slack funds, and you can start influencing the organization toward the vision. After you get the money, start small projects by tailoring the scope to the amount of available funding. There are always ways to get some small better capability, and learn from there. Start small -- early.

Be ready in June and July. No matter how tight the budget, the government budgeting and contracting process

usually results in money being available for those who are able to spend it starting in June or July every fiscal year. Be waiting in line with a list of unfunded requirements and procurement packages in hand. In most cases you'll be amazed at how much you can get. Not only will you get a capability, but you'll be the hero for taking advantage of the opportunity so quickly and getting a capability that no one expected during that fiscal year.

The ready, fire, aim process tracks well with the way the budgeting and funding process works in the government bureaucracy. It allows the telecommunications leaders and the users to tailor their targeting to match the amount of dollars available in the near term. Doing the firing early at small targets gets everyone smart on new capabilities at and helps build an early commitment. From these early actions can flow the incremental solutions to the long term vision.

Contrast this approach with the ready, aim, fire method where all the aiming is done first, with the firing as the final step. Here, the final commitment of funds is often too late, in too little amounts, with no early capability and no learning about possibilities. It can be a lot of planning and a little action with money being spent all at once at the end -- probably for yesterday's technology.

Sure, the ready, fire, aim approach requires discipline and forces user involvement early. The risk is that some

early target firings will not be successful, putting at jeopardy the access to additional funds. Given the rate of technology change today, the possibilities for success outweigh the chance of failure. In most cases, the information learned through small early trials, even if these trials turn out to be failures, will be well worth the dollars spent.

The ready fire aim model stimulates early action in little chunks rather than one big program expenditure. Having some capability and knowledge early makes it easier to justify continued funding support, either at the same level, or at some decreased level. Or the decision might be made to increase funding based on early successes and the benefits of getting to the vision sooner.

Try it. Use ready fire, aim to mesh the available money with emerging technologies and get early capabilities. The incremental results might be small, but the overall payoff will be big.

PART III

THE NEXT 12 SECONDS

Telecommunications is about competition, innovation,
risk, and uncertainty.

-- Peter Keen

If this sounds like war, it is. The days of managing the status quo for the telecommunications leader are over; It's now an environment of constant technological change and opportunity. The future heroes will be those who practice the skills of maneuver and learn how to take the right risks and win.

Where are we going?

Can we get there?

How will we know when we are there?

This part looks to the future and the opportunities that will be there for tomorrow's technical leader. Today's emerging technologies have the potential to change not only our organizations, but our society as a whole, to include many of our long-standing strategies for war fighting. What will be the measure of productivity on the battlefield of the future? The competitive edge will belong to those who are skillful at watching the trains of technology, and perfect the art and skill of getting on the right train at the right time.

The prospects are bright for military telecommunications leaders who lead their organizations through the maze of options into the vision of the future. And this isn't done by following a carefully planned process with no deviations ... it's done by learning how to dodge and dart right along with technology.

In part I, we looked at the history of man as a supermonth and showed that if of all of mankind's recorded history were to be scaled into a single month, the last 12 seconds would be the age of information and space. This final part provides some thoughts about what might be in store for mankind's next 12 seconds. Surely, the change of pace won't slow down, in fact it is more likely to accelerate. What the future will really be like no one knows; the one sure prediction is that the pace of change will be faster. After all, the experts from the last decade didn't have the highest success rate at predicting what the 1980s would be like. The President of Digital Equipment Corporation, Ken Olson, stated in 1977: "There's no reason for any individual to have a computer in their home." Or the remark of Thomas J. Watson in 1943: "I think there is a world market for about five computers."

The future belongs not to those military telecommunications leaders who dream up new ways to use new technologies. It belongs to those who recognize the potential of new and emerging capabilities, and are not

afraid to mold technologies to meet the unfilled needs of the users -- in combat and in peacetime.

The next chapter deals with some technologies that no telecommunications leader can afford to ignore over the next few years. Tomorrow's telecommunications warriors, armed with these strategic weapons could be the heroes of the next decade.

CHAPTER 14

STRATEGIC TECHNOLOGIES THAT WILL MAKE A DIFFERENCE

Nothing comes from doing nothing.

-- Shakespeare

All life is an experiment.

-- Oliver Wendell Holmes

One sure fact -- the train of technology change won't slow down. Those who do the early aiming today on tomorrow's developing technologies will be the clear winners. Do something now to get smarter on both the needs and capabilities for tomorrow. Don't wait. The earlier you get on tomorrow's train, the better.

What follows are some strategic technologies that tomorrow's telecommunications leaders cannot afford to ignore. The capabilities emerging in certain areas over the next five to ten years will have a significant impact on how we do our war fighting business over the next five years.

The focus here is on commercial technologies, not efforts or programs already under way in DOD. There are no real breakthroughs mentioned below, just continued evolution and maturing of already available technologies. It might take years, or even decades, for some of the concepts mentioned in this chapter to become reality. One sure thing -- they will be reality, in one shape or another!

WIRELESS DIGITAL COMMUNICATION

The non-DOD world is headed in the direction of worldwide, or global, digital networking through a technology called Integrated Digital Services Network. Why not capitalize on commercial developments here and extend this vision of a digital capability to the battlefield? mid-1990s? You can't get there overnight, but you can go in baby steps now.

The same technology that is enabling the transition from analog to digital in the landline and satellite worlds can and is being used to digitize radio links. For years, the military has invested millions in digital radio technologies for the battlefield, the result being highly capable links for certain command and control links, but too expensive a capability to proliferate all over the battlefield. This is not so today.

Today's commercially available technologies make the off-the-shelf high speed digital battlefield communications a reality for the telecommunications leader who has the vision. Sure commercially available technologies won't give the high anti-jam resistance of the more expensive militarized equipments, but is that degree of anti-jam needed everywhere on the battlefield?

Out of divestiture and deregulation grew the need for businesses to bypass the local telephone company networks

with their own private digital links. One capability that has been around for years in one form or another, but has recently matured overnight is digital short-haul microwave. Fast-growing companies faced with long waits and high costs for digital networks began installing their own. Often, it's relatively easy to get a network half way around the globe, compared to the resources and time needed to get that circuit "the last mile to a termination point. These short-haul microwave radios can provide highly directional high performance high speed links at distances of ten miles or more with small highly portable units. Some of the modern digital microwave radio links can be installed in less than an hour, not days. Today's battlefield and other military needs in this area are not unlike the needs of private industry today.

Getting the last mile or so can often be the biggest challenge, especially for high capacity voice and data networking. Oftentimes, it's not possible nor economical to install cabling and meet user networking needs in the time required. Other times, the networking needs might only be of a temporary or contingency nature. Short-haul digital microwave, operating in the 23 gigahertz band can fill these needs quickly and economically. These small terminals are easy to deploy and set up, and can be a vital link in the digital wireless needs for trunking high speed data to distances of ten or more miles. Just to meet restoral and

contingency needs, these microwave terminals can be the vital link to increased war fighting capability. Start with short-haul digital microwave now.

Digital short-haul microwave is only one small piece of the radio pie. When it comes to gaining more spectral capability and the need for link encryption, digital radio is the obvious choice, and commercial developments here will also directly apply to military needs.

How long will it take the military to field VHF, UHF, and EHF digital radio technologies? The proliferation of smart weapons and highly capable weapons systems dictates the need for better information-carrying capacity than FM and AM analog radio technology.

The need is for information networks on the battlefield. And, the battlefield needs are much more fluid than the office environment. Where the office will rely on fiber or copper, the combat area will need digital radio local area networks. The technology is here to do that. Success will come to those who mold digital wireless technology to meet the needs of the battlefield. We can't expect to rely on wire or optical cable to move all the information on tomorrow's battlefield. Things will be too dynamic. But that information can be moved quickly with a mix of cable

and digital radio. Today's time-division-multiple-access capabilities make real the possibility for each battlefield user to get their own slot in a wireless network "in the sky."

Over a decade ago, the defense department took the lead in pushing digital radio technology for the battlefield. This effort produced a product ahead of its time and expensive, but it works, and it's called the Joint Tactical Information Distribution System. Sorry, no acronyms, but for those of you who don't understand that last sentence, it's JTIDS. Unfortunately, being on that leading edge like it was JTIDS can only be afforded for the high priority command and control links. Now, years later, the commercial technology is here to multiply those digital wireless links in cheaper "non-militarized" boxes all over the battlefield. Digital radio technology, having varying degrees of jam resistance through advanced error-correction schemes can meet today's needs much better than the analog radio technology of mid-1900s vintage.

Commercial digital radio will hit the market before the end of this decade. Companies like International Mobile Machines in the United States, and Ericsson in Europe already have prototype systems in operation. The options

and flexibility that this technology could provide to military telecommunications are so advantageous as to warrant experimentation as soon as possible. The advantages of all-digital radio include:¹

- Spectrum efficiency: Industry has already demonstrated four simultaneous voice conversations, or 64 kilobits per second, on what is the equivalent of one FM analog channel today.

- Lower system costs: The multiplexed digital system effectively shares base station radios among multiple subscribers.

- Lower subscriber radio costs: In the long run, the radios will be less expensive than analog radios. The digital signal processing and voice coding make circuit miniaturization much easier.

- Better signal quality: With error correction techniques, it should be possible to get higher quality than with analog.

- Data transmission: Digital will provide much higher usable data rates per channel.

- Privacy/security: Digital radio without any encryption added gives some inherent privacy, but the real advantage of digital is the ease with which digital encryption capabilities can be added.

- Improved frequency reuse: The digital system can use timing and synchronization differences to reduce co-channel interference, thus allowing more efficient use of nearby frequencies.

- Network compatibility: Digital radio has the possibility of offering transparent compatibility with the emerging worldwide digital networks.

Digital radio has the possibilities of merging the push-to-talk-radio, the pager, and the telephone into one handheld unit, and include with that the local or wide area network connection for the desk or laptop computer. Extend that to the battlefield... Why shouldn't the combat troops just be able to arrive in theater and "plug into the wireless digital combat network?"

Set digital radio as your vision, and start working on it now. Do some early firing and aiming. Set up testbeds and prototype the capabilities to understand how to mold the the technology to meet combat needs. Industry is there to help. Don't expect to find pocket digital tomorrow, but it won't be as far in the future as you might expect.

PACKET RADIO DATA NETS

Another area closely paralleling digital radio, but remaining in the analog world is packet radio networking. The commercial world is discovering the value of packet radio technology as an alternative to physical lines for short and medium range data communication. Also, the technology is advancing beyond the experimental stage in DOD because of the advantages it provides, and the applications it opens up.

Basically, packet radio networking is a collection of packet-switched store and forward nodes that communicate with one another over multiple hops via broadcast radio to provide reliable computer-to-computer communication.² Multiple receivers can be used to relay messages over greater distances and to provide routing redundancy. Messages are short and bursty with each station having a unique address. Commercial packet radio devices available today can transmit at speeds of 9600 bits per second, with over 200 users assigned to a single channel.

The Defense Advanced Research Projects Agency has done extensive research and experimentation with packet radio nets and proven that nets with speeds up to 400 kilobits per second are possible for fluid applications and networks of moderate size.³

Packet radio networking provides a way to use today's analog radios in a way to give robust and reliable data transmission, even in distressed environments. Here are some of the advantages.⁴

- Mobility: A packet system continuously senses existing connectivity in real time and instantly exploits whatever connections exist in order to transmit data continuously.

- Rapid and convenient deployment: To install cable or fiber might take months or more. All that's required is to mount omnidirectional antennas with radios at each location. The commercial packet controllers are inexpensive and small and connect directly into the audio port on any radio, regardless of frequency. Others are made to operation with encryption devices. Distances vary depending upon radio power, but distances of 30 miles are possible.

- Simplified topological design and ease of reconfiguration: The broadcast capability of radio creates fluid connectivity. All nodes within line-of-site can receive another node's transmission. New nodes can be expanded or contracted dynamically as needs change.

- Unattended Operation: Once the operator insures that the radios are deployed to provide connectivity, the system does all the routing automatically.

- Reliability: Packet radio nets are redundant and robust. Parallel routes can easily be established to insure parallel paths exist to participate in the forwarding of a packet.

- Internetting: Adherence to commercial networking standards allows communications with other computers on other networks having the same standards. This can be either satellite, terrestrial, or local area networks.

- Tactical Applications: Packet radio has dynamic and error detection and correction protocols that resist electronic jamming attacks and other radio noise in the in the combat environment.

Packet radio nets can be installed inexpensively today to move information around military installations, within buildings, or even from vehicle to vehicle for mobile applications. Use existing VHF or UHF authorized frequencies or get creative and experiment in free areas of the 1350 - 1400 Megahertz band. This band is an exclusive military band currently allocated primary for radiolocation, and secondary for Fixed and Mobile use. The band is very used and offers ample bandwidth for applications like packet radio networking. Try it!

OPTICAL DISC STORAGE

Optical storage technology will do for the computer revolution what gunpowder did for warfare... it will change everything including our basic approaches to how we access and use information, not to mention the needs to move more and more information, at faster and faster rates. To understand the storage capacity of optical versus magnetic media, imagine a stack 12 feet tall of 5 1/4 inch computer disks. Next to that stack, place one compact disc read-only memory, or CD-ROM. Just that one CD-ROM could store everything in the entire 12-foot stack of magnetic disks, and then more. An entire encyclopedia can fit on less than one-fifth of a disc. When it's possible to have the entire recorded history of warfare on one disk attached to your computer it's not difficult to imagine the impact.

Write once, read only optical storage technology is available today, and read-write technology is expected before the end of the decade.

What the real impact of optical storage technology will be is anybody's guess. Just focusing on the information aspects of this new technology provide some interesting thoughts:

- Interaction. For the first time, it will be possible to interact with a document.²⁵ Where now, a paper document is only two dimensional, optical storage can add another dimension -- the ability to tailor a document to a user.

There is no reason why one should not be able to "zoom in" on any word or phrase in a document to gain additional information. The capability would be there to index every word or number in a document.⁶ Optical storage can provide this new dimension.

- Decision making. The fundamental benefit of optical storage is the wealth of information that is available all at once.⁷ It's possible to do a few searches on the desktop computer and get answers to questions that it could take a staff days to research. Combat applications from the cockpit to the logistics warehouse are possible.

- Education and research. People learn best when they can actively explore information, especially if they are in active control of viewing, structuring, and digesting that information.⁸ Optical storage can give individualized desktop training -- and not only in text, but with interactive video images and sound. Put a library on optical storage, and what used to take months to research might only require hours.

Optical storage opens up new possibilities and new challenges for the military telecommunications leader. One assumption is that more information will pass to more people through more networks. The demand for information is elastic ... "it is sensitive to cost and the time required to get an answer."⁹ And the costs of optical storage are dropping every day. Will the networks be there?

FIBER OPTICS

From the office to the battlefield, networking and operational needs will drive you to use fiber over copper. The sooner you do it, the better off you will be.

The only limit on fiber capacity is in the electronics, or future photonics, at the termination points. The theoretical capacity of fiber is in the trillions of bits per second. The advantages to installing fiber now outweigh the disadvantages of having to do it later. John Gantz emphasizes:

One technology that seems optimal for preserving past investment while offering incredibly high performance levels is that of fiber-optic communications. Although the market has been misled many times -- forecasters have learned that implementation has less to do with the economics of traffic carrying capacity than with the economics of laying cable and retraining splicers... ¹⁰

The rate of acceptance of fiber for military telecommunications will continue to grow over the next few years. The significant advantages of fiber are: ¹¹

- Bandwidth. Two fibers can handle the capacity of several thousand 24-gauge wire pairs. Combat damage to multi-pair cable can take hours to repair, while fiber can take minutes.

- Size, weight, and flexibility. Light weight and small size equate to increased mobility in combat. In weapon systems, this equates to more combat capability.

- Immunity from interference. Fiber is immune to nuclear electromagnetic pulse, lightning, cross-talk, motors, and power lines.

- Security. Fiber is extremely difficult to tap.

Get your advanced technology people tracking and experimenting with fiber now. For new networking applications, if the option is copper or fiber, install fiber. If there is not a fiber option, ask why not?

IMAGE COMMUNICATION

Images are joining voice and data on the networks. As the information float continues to collapse, and as certain technologies mature, the need for visual over purely textual communication will rise dramatically. We are already beginning to see this trend in the latest advances in microprocessor and software technology. Microprocessors are more powerful, and software is finally giving the users windows and graphics, and multitasking. Couple these two advances with optical storage technology, and the future can only go one way -- more -- more information on more networks!

Document scanners and facsimile units now interface directly with microcomputers. Today's software enables a normal human being, not just the techie, to move beyond the realm of text and easily work with ideas and concepts in the form of visuals and graphics.

And, expanding beyond the desktop will be the users' expectations for networks to carry the images.

Things won't be any different on the battlefield. In fact, images will be more important in the high intensity high-tech war where a craving for simplicity in ideas and knowledge will override any need for quantities of textual information. One well constructed image or graphic may very well save the battle, or even the war.

The telecommunications warriors better be there, helping shape the users' understanding of the image networking needs, and building the knowledge highways for those needs.

FASTER AND MORE POWERFUL COMPUTERS

The only certain trend is that computer technology advances will continue to put more and more information power in the hands of the user, and in smaller and more powerful boxes. Advances like the 80386 processor will distribute more network intelligence closer and closer to the users. After all, being there with the user is where it makes the most sense. The technical leaders who understand this trend will serve the users better.

Keep your advanced technology group tackling the microcomputer advances. If you have the money, purchase the a few of the latest micros and get your technology group experimenting with the users. It's the only way to keep up, and to keep smart, on the options available. No one else will do it for you.

VIDEO CONFERENCING

Video conferencing is a capability that is lost in the fog and friction of the telecommunications battlefield. Maybe John Naisbitt is right when he says in MEGATRENDS that teleconferencing is so rational that it will never succeed. Of course, in the early 1900s the Chairman of Western Union turned down exclusive patent rights to the telephone claiming: "what use would this company have for an electrical toy?"

From a telecommunications technology standpoint, the limiting factor in videoconferencing has been availability of bandwidth. Advanced video digital compression techniques now make videoconferencing feasible on today's networks. It remains expensive, but doable, if the requirements can be justified.

Today's problems with videoconferencing rest more with how people currently use and share information than they do with technology.

Where videoconferencing has been tried and failed it is usually because of one or both of two reasons.

First, video conferencing isn't needed in all cases. Sometimes a conference phone call will do just fine. If a user perceives that more time is wasted by leaving their office and going to a videoconference center or room, then videoconferencing will be a failure. A video conference does not, and should not, replace the telephone.

Second, a videoconference requires planning, and it must be orchestrated. Video meetings require that someone put the right information in front of the camera at the right time. If you have nothing meaningful to put in front of the camera, the only alternative is for the participants look at others faces throughout the meeting. As an analogy, imagine watching the nightly news for a half hour and seeing nothing but the newscaster reading the news. It wouldn't be long before you would be listening to the news on the radio.

If you don't at least get as much out of a video conference as the the evening news then the technology is probably not worth it.

Videoconferencing is expensive. The successful video meeting cannot just be picture telephone, it has to be an orchestrated mixture of graphics, visuals, and face-to-face video. Successful videoconferencing is a mini video

production. And that takes work, it doesn't just happen like a phone call. Successful videoconferencing requires an information boss or director, someone responsible for following the dynamics of the meeting and showing the right information at the right time.

Teleconferencing is a technology that you cannot afford to ignore. It is especially valuable for educational purposes. Nevertheless, has not yet received significant acceptance as an alternative to face-to-face meetings, or even telephone conversations. Maybe, as we improve our skills at accessing and moving information through networks, we'll get better at the skills required for successful videoconferencing. Tread lightly here, but be ready to go.

EMBEDDED ENCRYPTION

For both the military communicator and the user, encryption has always been an albatross. The communicator wanted to encrypt everything, and the users only got more frustrated as encryption was added because it often took away capability, and it was not user-friendly. Technology advances, coupled with advanced key distribution will finally integrate high-quality, transparent encryption inside the user-operated systems.

New policies allow vendors to build encryption into products. These new capabilities and policies still require creative telecommunications leaders who specify embedded encryption early in the planning phases of projects, and are willing and knowledgeable enough to work with industry to make embedded encryption happen. Get your technology group smart on the embedded encryption issues and options early.

SMALL TRANSPORTABLE DIGITAL SATELLITE TERMINALS

Commercial Ku-band small satellite terminals can offer a very attractive option for reaching many dispersed ground sites via two-way voice and data. Networks between 20 and 100 sites can be a very responsive and economical alternative to terrestrial communications, especially when supported by a central privately installed hub. The cost of a private 100 station network, with hub, would be about two million dollars.¹² One significant advantage of this approach is the ability to relocate or install remote sites as contingencies and mission needs dictate. The user can control all network capability, both at remote sites and at the hub facility. The author's experiences with satellite networks show their reliability to be much greater and their bit error rates over time much lower than comparable terrestrial circuits. Someday, new military capabilities like MILSTAR might fill your networking needs, but are you willing and able to wait until that time? Today's small

aperture commercial terminals can fill your critical needs, especially in peacetime.

PACKETIZED VOICE

Just a few words here. As circuit bandwidths and speeds increase, so do the possibilities, and packet voice is one. Several vendors recently announced packet voice capabilities in their multiplexers. Where this technology is headed is still up for grabs, but if voice can be routed over non-dedicated lines, and then reconstructed at the terminating point, the possibilities are many. Have your technology group keep track of developments in this area and experiment where possible. Packetized voice can significantly expand the networking possibilities. Watch this area closely.

READY, FIRE, AIM

Who knows what is in store for the next 12 seconds of our supermonth? This chapter provided some thoughts on strategic technologies which could, and probably will, make a difference.

Appendix 2 is a ready, fire, aim checklist that can be used as a guide to action throughout all phases of managing telecommunications technology. It provides reminders and thoughts for each phase of the concept.

The future will belong to those who recognize the opportunities early and begin learning and molding emerging technologies to fit their vision of the future. Major Myer had only one telecommunications technology to make work during the Civil War -- the telegraph. Now, the possibilities are endless, and the wars will be more intense.

This book is designed to give the telecommunications leader practical ideas for managing new and emerging capabilities to meet the needs of today's informed users. The concept presents a proactive way deal with military telecommunications as we move to the end of the twentieth century. If we expect to maintain an effective and responsive war fighting capability into the next century, we'll need innovative and aggressive technical leaders to get us there. Telecommunications will become more and more of an important strategic weapon in the "next 12 seconds." We need good strategic telecommunications leaders to get us there. The old way of doing business won't do it. A new approach of ready, fire, aim will.

Sure, this approach is not for the faint hearted or the no-risk takers, but neither is war.

EPILOGUE

BACK FROM THE FUTURE

After finishing this, I went out to celebrate at the local pub. There, I ran into a rather strangely attired young man. He told me that he was a captain in the Air Force who accidentally ended up here, and that he was from the year 2007. He was a test pilot participating in a special flight test of a new fighter that somehow passed him through a time warp back to our present. I found him fascinating to talk with, and before he left for what I assume was the future, I did get him to tell me the a few things about what happened between now and the year 2007.

He told me about a prolonged, great world crisis that started in 1991. The situation was serious, and the US learned quickly how to innovate and get ready for what was expected to be an all-out war. My frustration was that he refused to tell me what really happened, or the outcome. He did tell me the crisis lasted over 32 months, and that the entire United States ended up mobilized for war.

I asked him what we had learned about telecommunications since the present time. His answer: "We learned a lot very quickly, suddenly realizing that our combat networking and communications weren't current with the commercial technologies available in 1991." My mind wandered to

technology of the telegraph to fight the Civil War.

Some things that I remember him telling me were amazing capabilities most of us never expected to see become reality in our lifetimes. Jumping to the future as if it were the present, he told me...

"Fiber is on the battlefield, everywhere. Innovative people developed a capability to deploy fiber optic battlefield communications links by using the technologies of laser-guided weapons. The users just laser designate the laydown point, and then the sender fires off the fiber reel in a missile toward the laser designated target. If a fiber link gets damaged, we merely "shoot another one" from one end of the link to the other.

"We have a capability that broadcasts wireless digital burst communications in the combat area. Everyone in combat can talk to anyone all over the battlefield. All battle elements were linked via data terminals. It became possible for smart weapons systems to get target information directly from others on the battle area over digital radio. All the person had to do once the target was acquired is verify the lock-on and fire. The weapon does the rest of the aiming as it moves toward the target while the combat troop fires and forgets."

"Command posts and battlefield headquarters have a mix of digital wireless and fiber networking. They are netted together by digital local and wide area "networks in the

sky." Redundant terrestrial and satellite communications provide the alternate means of information transfer and sharing."

"The intelligence sources provide intelligence products directly to the combat elements -- the fighters, tanks, ships via the combat digital wireless networks. And the information is not textual, it is visual in the form of graphics and pictures."

"We finally learned that there is no magic to the 2800-3000 kilohertz bandwidth for voice communications channels. Once we got digitized voice as the norm, it became easy to move it around within a software-defined network where capacities could easily be expanded and contracted as the needs and combat realities dictated. But at no time are people totally out of the loop, they just might be degraded for a minute or two at the most."

"On the battlefield of 2007, we don't distinguish among the radio, the telephone, and the computer. Those individual devices became obsolete around the turn of the century, a result of continued circuit miniaturization and the emergence of digital radio. Everyone carries their own shirt-pocket-sized personal communications device that communicates with the network via encrypted digital wireless techniques."

"Satellites in orbit now act as switches in space. Movable in-orbit spot beam technology directs

communications capacities where they're needed in real time. Those same satellites link the airborne command posts via high capacity laser communications."

"The world is now a global network. Everyone coming to the war merely plugs into this network. If it is not available, we create it."

" Everyone in the military, regardless of rank, has a personal electronic mail account. Anyone can talk to anyone or ask questions or share knowledge. The paper mill, as you know it today, is gone -- replaced by electrons. Disfunctional layers in our organizations went away over time -- replaced by smart networking of people and work groups."

At that point, I excused myself to visit the mens room. Upon my return, the "Captain of the Future" was nowhere to be found. I drank the last few sips of my beer and left, still wondering ... was there more? I guess we'll find out soon.

APPENDIX 1

FREE TELECOMMUNICATIONS PERIODICALS

FEDERAL COMPUTER WEEK
P.O. Box 602
Winchester, MA 01890

INFORMATION WEEK
Circulation Dept.
P.O. Box 2050
Manhasset, NY 11030

INFOSYSTEMS
Hitchcock Publishing Co.
P.O. Box 3007
Wheaton, IL 60189

INFO WORLD
(The PC News Weekly)
P.O. Box 1018
Southeastern, PA 19398

NETWORK WORLD
(Weekly for leading users of
Communications Products and
Services)
P.O. Box 1021
Southeastern, PA 19398

PC WEEK
Circulation Department
One Park Ave - 4th Floor
New York, NY 10016

TELECOMMUNICATIONS PRODUCTS
+ TECHNOLOGY
Pennwell Publishing Co.
P.O. Box 1425
119 Russell Street
Littleton MA 01460

TELECOMMUNICATIONS
685 Canton Street
Norwood, MA 02062

WASHINGTON TECHNOLOGY
1953 Gallows Rd.
Suite 130
Vienna, VA 22180

APPENDIX 2

READY, FIRE, AIM CHECKLIST FOR TELECOMMUNICATIONS ORGANIZATIONS

READY

What is our vision of the future?

How long will it take to get there?

Who in the organization needs to be involved?

What are the organizational and cultural implications?

What is the "bottom line" mission? How can we do it better?

What are the risks of any change?

What are the risks of not changing?

What do we need for combat?

Who are the users? Are they involved?

Are there commercial standards established? If not why not?

Should we push for standards?

Have we chosen a "vendor unique" standard? If so, why?

What targets can we shoot at early?

Are the users committed to early target shooting?

Are the users more committed to action than the your telecommunications organization?

Are the users ready to "do it themselves"? If so, why?

FIRE

What are small targets we can shoot at quickly to get smarter on the overall vision?

What small capability we can attain now?

Where are the slack dollars we can use in small amounts to get smart quickly?

What are the risks of this early action?

Are the users involved in this early firing? If not, why?

Are the users or customers committed to action?

Are the users requirements established? Changing? Or, should they be expected to change as a result of early firing?

What are the organizational forces that will affect early firing at targets?

How many targets should we fire at early?

How can industry help us? What prototype equipment can we evaluate early?

Is industry willing to fire early at targets along with us?

Is the contracting officer involved in this early firing?

Are there lessons learned from other target shooting and aiming that we should apply? I.e. Shoot more targets, or or forget some others.

Are we headed toward the vision?

AIM

What are we learning as we shoot small targets early?

Are there some bigger targets we should change the aim toward?

How often should we aim?

What are the organizational aiming forces? Are they helping hit the target? If not, why not, and what can be done about it?

Are there targets that we should stop aiming at and "let the weapon go on"?

How would we adapt for combat? Why aren't we doing it that way in peacetime?

How far can we deviate from the target and still "kill" it?

Are there other targets we should fire at as a result of other targets hit?

Are the users committed and aiming along with the telecommunications organization?

Is the telecommunications organization aiming along with the users?

Is there strategic training that is needed?

Is industry aiming along with you?

Are there standards that we should be aiming toward?

Are there technology breakthroughs that make "hitting the target" not worthwhile anymore?

Are there technology breakthroughs that necessitate "hitting more targets" to get smarter earlier?

What will we learn after we hit this target?

What did we learn after we hit the last target?

Are we evolving toward the overall vision?

LIST OF REFERENCES

CHAPTER 1

1. Pelton, Joseph N. "Telecommunications and Life in the Year 2000." Telecommunications in the Year 2000: National and International Perspectives. ed. by Indu B. Singh, Norwood, New Jersey: Ablex Publishing Corp., 1983, p. 5.

2. Ibid., p. 6.

CHAPTER 2

1. Plum, William R. The Military Telegraph During the Civil War in the United States, with an Exposition of Ancient and Modern Means of Communication, and of the Federal and Confederate Cipher Systems; also a Running Account of the War Between the States. Chicago: Jansen, McClurg & Co., 1882, Vol I, p. 68.

2. Plum, Vol II, p. 86.

3. Ibid., p. 86.

4. Ibid., p. 87.

5. Ibid., p. 88.

6. Ibid., p. 88.

7. Plum, Vol I, p. 190.

8. Plum, Vol II, p. 337.

9. Ibid., p. 187.

10. Ibid., p. 337.

11. Plum, Vol I, p. 11.

CHAPTER 3

1. Naisbitt, John. Megatrends: Ten New Directions Transforming Our Lives. New York: Warner Books, 1982, p. 15.

2. Keen, Peter G. W. Competing in Time: Using Telecommunications for Competitive Advantage. Cambridge, Mass. : Ballinger Pub. Co., 1986, p. 10.

CHAPTER 4

1. Gantz, John. "The Growing Power of the TELECOM Manager: White Paper to Management." Telecommunications Products + Technology, October 1986, pp. 33-54.
2. Bennis, Warren G., and Nanus, Burt. Leaders: The Strategies for Taking Charge. New York: Harper & Row, 1985, p. 21.
3. Keen, p. 19.
4. Deal, Terrence E., and Kennedy, Allan A. Corporate Cultures: The Rites and Rituals of Corporate Life. Reading Mass. : Addison-Wesley Pub. Co., 1982, p. 4.
5. Clausewitz, Karl Von. On War. Ed, and translated by Michael Howard and Peter Paret. Princeton, New Jersey: Princeton University Press, 1976, p. 178.

CHAPTER 5

1. Keen, p. 217.
2. Ibid., p. 218.
3. Ibid., p. 221.

CHAPTER 6

1. Drucker, Peter F. The Frontiers of Management: Where Tomorrow's Decisions are Being Shaped Today. New York: Truman Talley Books, 1986, p. 203.
2. Ibid., p. 204.
3. Ibid., p. 206.
4. Ibid., p. 351.
5. Deal and Kennedy, p. 191.

CHAPTER 9

1. Clancy Thomas, Red Storm Rising. New York: G.P. Putnam's Sons, 1986, p. 469.
2. Diebold, John, Managing Information: The Challenge and the Opportunity. New York: The American Management Associations, 1985, p. 6.
3. Ibid., p. 35.
4. Naisbitt, John, and Aburdene, Patricia. Re-inventing the Corporation: Transforming Your Job and Your Company for the New Information Society. New York: Warner Books, Inc., 1985, p. 127.
5. Puette, Robert, "Executive View of Microcomputers." Infosystems, September 1986, p. 30.
6. Ibid., p. 28.
7. Toffler, Alvin, The Adaptive Corporation. New York: McGraw-Hill Book Co., 1985, p. 10.

CHAPTER 10

1. Yuriyama, Juro, "Future Telecommunications in Japan " Telecommunications in the Year 2000: National and International Perspectives. ed. by Indu B. Singh, Norwood, New Jersey: Ablex Publishing Corp., 1983, p. 31
2. Ibid., p. 32.
3. Ibid., p. 32.
4. Conroy, Cathryn, "Electronic Mail." Online Today, January 1987, pp. 15-16.

CHAPTER 14

1. Calhoun, George, "The Digital Future for Mobile Radio." Telecommunications, August 1986, pp. 52-53.
2. Shacham, Nachum, and Tornow, Janet. "Packet Radio Networking." Telecommunications, September 1986, p. 43.
3. Ibid., p. 64.
4. Ibid., p. 48.
5. The New Papyrus, CD ROM: The Current and Future State of the Art. ed. by Steve Lambert and Suzanne Ropiequet, Bellevue, WA.: Microsoft Press, 1986, p. 176.
6. Ibid., p. 138.
7. Ibid., p. 192.
8. Ibid., p. 191.
9. Ibid., p. 560.
10. Gantz, John. "Telecommunications: Technology at a Watershed." A White Paper to Management, Telecommunications Products + Technology, October 1984, p. w/18.
11. Blustain, Harvey, "Fiber-Optic Technology Adopted for Military Communications." Microwave Systems News & Communications Technology, January 1987, p. 32.
12. Youssefzadeh, Emil. "Are VSATs a Viable Bypass Alternative for Two-way Data Traffic?" Network World, January 19, 1987, p. 37.

END

DATE

FILM

JAN
1988