Chapter 2

Command and Control Theory

"Confronted with a task, and having less information available than is needed to perform that task, an organization may react in either of two ways. One is to increase its information-processing capacity, the other to design the organization, and indeed the task itself, in such a way as to enable it to operate on the basis of less information. These approaches are exhaustive; no others are conceivable. A failure to adopt one or the other will automatically result in a drop in the level of performance."

—Martin van Creveld, *Command in War*

Having reached a common understanding of the nature of command and control, we turn to developing a theory about the command and control process that will in turn serve as the basis for creating an effective command and control system.

POINT OF DEPARTURE: THE OODA LOOP

Our study of command and control theory starts with a simple model of the command and control process known as the OODA loop.[1] The OODA loop applies to any two-sided conflict, whether the antagonists are individuals in hand-to-hand combat or large military formations. OODA is an acronym for observation-orientation-decision-action, which describes the basic sequence of the command and control process. (See figure 2.) When engaged in conflict, we first observe the situation—that is, we take in information about our own status, our surroundings, and our enemy. Sometimes we actively seek the information; sometimes it is thrust upon us. Having observed the situation, we next orient to it—we make certain estimates, assumptions, analyses, and judgments about the situation in order to create a cohesive mental image. In other words, we try to figure out what the situation means to us. Based on our orientation, we decide what to do—whether that decision takes the form of an immediate reaction or a de- liberate plan. Then we put the decision into action. This in-

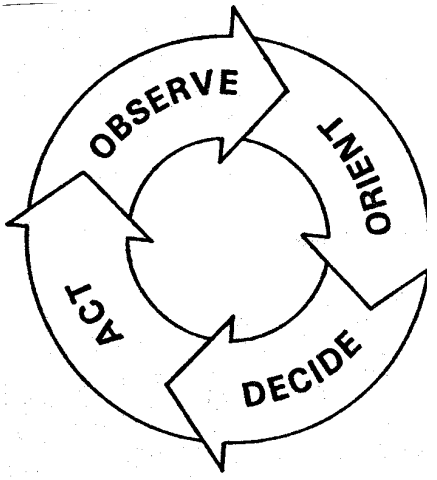

Figure 2. The command and control process: The OODA loop.

cludes disseminating the decision, supervising to ensure proper execution, and monitoring results through feedback, which takes us full circle to the observation phase. Having acted, we have changed the situation, and so the cycle begins again. It is worth noting that, in any organization with multiple decision makers, multiple OODA loops spin simultaneously, although not necessarily at the same speed, as commanders exercise command and control at their own level and locale.

Importantly, the OODA loop reflects how command and control is a continuous, cyclical process. In any conflict, the antagonist who can consistently and effectively cycle through the OODA loop faster—who can maintain a higher tempo of actions—gains an ever-increasing advantage with each cycle. With each reaction, the slower antagonist falls farther and farther behind and becomes increasingly unable to cope with the deteriorating situation. With each cycle, the slower antagonist's actions become less relevant to the true situation. Command and control itself deteriorates.

The lesson of the OODA loop is the importance of generating tempo in command and control. In other words, *speed is an essential element of effective command and control*. Speed in command and control means shortening the time needed to make decisions, plan, coordinate, and communicate. Since war is competitive, it is not absolute speed that matters, but speed relative to the enemy: the aim is to be faster than our enemy, which means interfering with the enemy's command and control as well as streamlining our own. The speed differential does not necessarily have to be a large one: a small advantage exploited repeatedly can quickly lead to decisive results. We should recognize that the ability and desire to generate a higher operational tempo does not negate the willingness to bide time when the situation calls for patience. The aim is not merely rapid action, but also meaningful action.

THE INFORMATION HIERARCHY

We use the term *information* generically to refer to all manner of descriptions or representations from raw signals on the one hand to knowledge and understanding on the other. But it is important to recognize that there are actually four different classes of information. We must understand the differences between these classes because they are of different value in supporting command and control. (See figure 3.) We must also understand what happens to information as it moves between levels on the hierarchy.[2]

Raw data comprise the lowest class of information and include raw signals picked up by a sensor of any kind (a radio antenna, an eyeball, a radar, a satellite) or communicated between any kind of nodes in a system. Data are bits and bytes transferred between computers, individual transmissions sent by telephone or radio or facsimile, or a piece of unprocessed film. In other words, raw data are signals which have not been processed, correlated, integrated, evaluated, or interpreted in any way. This class of information is rarely of much use until transformed in some way to give it some sort of meaning.

The next class is data that have been processed into or have been displayed in a form that is understandable to the people

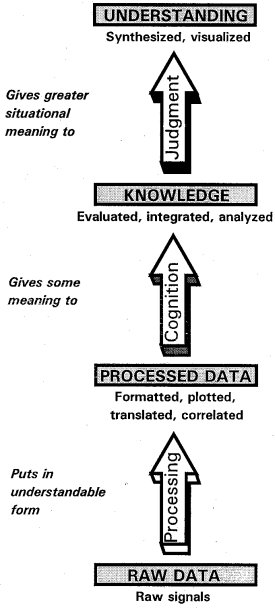

Figure 3. The information hierarchy.

who must use them.* Processed data include film that has been developed into a photograph, radio transmissions copied into a standard report format, a computer file displayed as text or a graphic on a screen, grid coordinates plotted on a map, or an intercepted enemy message deciphered. The act of processing in itself gives the data a limited amount of value. Clearly, processed data are more useful to people than raw data—and some may have immediate, obvious and signifi-cant value—but they have not yet been evaluated or analyzed.

The next rung on the information hierarchy is knowledge—data that have been analyzed to provide meaning and value. Knowledge is data which have been evaluated as to reliability, relevance, and importance. Knowledge is various pieces of processed data which have been integrated and interpreted to begin to build a picture of the situation. For example, military intelligence is a form of knowledge as compared to combat information which has not yet undergone analysis and evaluation. Likewise, situation reports pieced together to create an estimate of the situation represent knowledge. At this level, we are starting to get a product which can be useful for decisionmaking.

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* This class is often referred to as "information," in a more specific usage of that term. To avoid confusion, we will continue to refer to this class as "processed data" and will use "information" to refer to the full range of information classes.

The highest class of information is understanding—knowledge that has been synthesized and applied to a specific situation to gain a deeper level of awareness of that situation. We may *know* what is going on; we *understand* why. Understanding results when we synthesize bodies of knowledge, use judgment and intuition to fill in the gaps, and arrive at a complete mental image of the situation. Understanding means we have gained situational awareness. Understanding reveals the critical factors in any situation. It reveals the enemy's critical vulnerabilities. It reveals the patterns and logic of a situation. Understanding thus allows us to anticipate events—to recognize in advance the consequences of new or impending developments or the effects of our actions on the enemy. We try to make understanding the basis for our decisions—although recognizing that we will rarely be able to gain full under- standing.

The gradations between the different classes of information are not always very clear. It is not always easy to tell the exact difference between raw and processed data, for example. But it is important to realize that there are differences and that knowledge is usually more valuable than data, for instance. Moreover, it is also important to recognize that information is transformed as it moves up the hierarchy and to understand the forces that cause that transformation.

Raw data are turned into processed data, as we might expect, through *processing,* an activity involving essentially the

rote application of procedure. Processing includes formatting, translating, collating, plotting, and so on. Much processing occurs automatically (whether by humans or by machines) without our even being aware that it is taking place—such as when a facsimile machine converts bits of data into understandable text or graphics. In many cases, machines can process data much more quickly and efficiently than people.

We turn processed data into knowledge through the activity of *cognition*—the act of learning what something means, at least in general terms. To a degree, cognition may be based on rules of logic or deduction ("If *A* happens, it means *B*"). Expert systems and artificial intelligence can assist with cognition to a certain extent—by helping to integrate pieces of processed data, for example. But cognition is primarily a human mental activity—not primarily a procedural act like processing, but an act of learning.

We transform the complex components of knowledge into understanding through *judgment*, a purely human skill based on experience and intuition, beyond the capability of any current artificial intelligence or expert system. Judgment simply cannot be reduced to procedures or rules (no matter how complex).

We should note that as information moves up the hierarchy from data toward understanding, an integration occurs. Multi-

ple bits of raw data are pieced together to make processed data. Numerous pieces of processed data coalesce into knowledge. Various bodies of knowledge distill into understanding. This integration is essential to eventually reaching understanding because it involves reducing the total number of "pieces" that must be considered at any one time. The vast number of bits of raw data that describe any situation would overwhelm any commander *if they had to be considered singly*. It takes a certain amount of time and effort to make these integrations, but without this effort the commander would be overloaded by a staggering number of things to consider.

By nature, data are significantly easier to generate, identify, quantify, reproduce, and transmit than are knowledge and understanding. But commanders need knowledge and understanding in order to make effective decisions. Likewise, subordinates need not merely data but knowledge and understanding of the commander's concept and intent. The goal in command and control should not be collecting, processing, and communicating vast amounts of data—and increasing the danger of information overload in the process—but approaching understanding as closely as possible. However, we cannot simply provide commanders with ready-made understanding. They will have to make the final judgments themselves. But we can strive to provide information that is as easily assimilable and as close to final form as possible. This means providing information in the form of images.

IMAGE THEORY

Human beings do not normally think in terms of data or even knowledge. People generally think in terms of ideas or images—mental pictures of a given situation. Not only do people generally think in images, they understand things best as images and are inspired most by images.[3]

We can say that an image is the embodiment of our understanding of a given situation or condition. (The term *coup d'oeil*, which refers to the ability of gifted commanders to intuitively grasp what is happening on the battlefield, means literally "stroke of the eye.") Images apply not only to the military problems we face but also to the solutions. For example, a well-conceived concept of operations and commander's intent should convey a clear and powerful image of the action and the desired outcome.

People assimilate information more quickly and effectively as visual images than in text. The implications of this are widespread and significant, ranging from technical matters of presentation—the use of maps, overlays, symbols, pictures, and other graphics to display and convey information visually—to conceptual matters of sharing situational awareness and intent.

Our image of a situation is based not just on the facts of the situation, but also on our interpretation of those facts. In other words, it is based on our intuition, appreciation, judgment, and

so on, which in turn are the products of our preconceptions, training, and past experiences. New information that does not agree with our existing image requires us to revalidate the image or revise it—not easily done in the turbulence and stress of combat. The images we create and communicate to others must approximate reality. Conversely, if we want to deceive our enemies, we try to present them with an image of the situation that does not match reality and so lead them to make poor decisions.

We generate images from others' observations as well as our own. In general, the higher the level of command, the more we depend on information from others and the less on our own observations. All but the smallest-unit commanders receive most of their information from others. This can cause several problems. First, when we observe a situation firsthand, we have an intuitive appreciation for the level of uncertainty—we have a sense for how reliable the image is—and we can act accordingly. But when we receive our information secondhand, we usually lose that sense. This is especially dangerous in a high-technology age in which impressively displayed information appears especially reliable. Second, we can sense more about a situation from firsthand observation than we can faithfully communicate to others or, at least, than we have time to communicate in a crisis. Third, since each of us interprets events differently, the information we communicate is distorted to some degree with each node that it passes through on its way to its final destination. And fourth, this same information is

likewise delayed at each node. Since the value of information exists in time, this delay can be critical.

Commanders need essentially three different pictures. The first is a closeup of the situation, a "feel" for the action gained best through personal observation and experience. From this picture, commanders gain a sense of what subordinates are experiencing—their physical and moral state. From this image, commanders get a sense of what they can and cannot demand of their people. In the words of Israeli General Yshayahor Gavish about his experience in the 1967 Arab-Israeli war: "There is no alternative to looking into a subordinate's eyes, listening to his tone of voice."[4]

The second picture is an overall view of the situation. From this view, commanders try to make sense of the relative dispositions of forces and the overall patterns of the unfolding situation. From this view, they also gauge the difference between the actual situation and the desired end state. The desired result of the overall view is a quality we can call "topsight"—a grasp of the big picture. If "*insight* is the illumination to be achieved by penetrating inner depths, *topsight* is what comes from a far-overhead vantage point, from a bird's eye view that reveals *the whole*—the big picture; how the parts fit together."[5]

The third picture we try to form is the action as seen through the eyes of the enemy commander from which we try to deduce possible enemy intentions and anticipate possible enemy moves. Of the three pictures, the first is clearly the most

detailed but usually offers a very narrow field of vision. Commanders who focus only on this image risk losing sight of the big picture. The second picture provides an overall image but lacks critical detail—just as a situation map does not capture more than a broad impression of the reality of events on the battlefield. Commanders who focus only on this image risk being out of touch with reality. The third picture is largely a mental exercise limited by the fact that we can never be sure of what our enemy is up to.

Squad leaders or fighter pilots may simultaneously be able to generate all three images largely from their own observations. Higher commanders, however, feel a tension between satisfying the need for both the closeup and overall images—the former best satisfied by personal observation at the front and the latter probably best satisfied from a more distant vantage point, such as a command post or higher headquarters.

As we have mentioned, any system which attempts to communicate information by transmitting images will suffer from a certain degree of distortion and delay. There are several ways to deal with this problem. The first is for commanders to view critical events directly to the greatest extent possible (consistent with the competing need to stay abreast of the overall situation). In this way they avoid the distortions and delays which occur when information filters through successive echelons.

Because as war has evolved, it has become increasingly complex and dispersed, commanders have found it increasingly difficult to observe all, or even most, critical events directly. One historical solution to this problem is a technique known as the *directed telescope*, which can be especially useful for gaining a closeup image. This technique involves using a dedicated information collector—whether a trusted and like-minded subordinate or a sensor—to observe selected events and report directly to the commander. Commanders may direct the "telescope" at the enemy, at the surroundings, or at their own forces. In theory, because these observers report directly, the information arrives with minimal delay or distortion. Directed telescopes should not replace regular reporting chains but should augment them—to avoid burdening lower echelons with additional information gathering and to check the validity of information flowing through regular channels. Improperly used, directed telescopes can damage the vital trust a commander seeks to build with subordinates.[6]

The second way to deal with the problems of delay and distortion of information is to rely on *implicit communications* to the greatest extent possible. Implicit communication minimizes the need for explicit transmission of information. Theoretically, because implicit communication requires indi- viduals who share a common perspective, information will suffer minimal distortion as it passes up or down the chain. We will discuss implicit communication in greater detail later.

The third way to deal with the problems of delay and distortion of information, also discussed later in more detail, is to decentralize decisionmaking authority so that the individual on the spot, the individual who has direct observation of the situation at that spot, is the person making the decisions.

THE COMMAND AND CONTROL SPECTRUM

Historically, there have been two basic responses to the fundamental problem of uncertainty: to pursue certainty as the basis for effective command and control or to accept uncertainty as a fact and to learn to function in spite of it.

The first response to uncertainty is to try to minimize it by creating a powerful, highly efficient command and control apparatus able to process huge amounts of information and intended to reduce nearly all unknowns. The result is *detailed* command and control. Such a system stems from the belief that if we can impose order and certainty on the disorderly and uncertain battlefield, then successful results are predictable. Such a system tends to be technology-intensive.

Detailed command and control can be described as *coercive*, a term which effectively describes the manner by which the commander achieves unity of effort.[7] In such a system, the commander holds a tight rein, commanding by personal di-

rection or detailed directive.[8] Command and control tends to be centralized and formal. Orders and plans are detailed and explicit, and their successful execution requires strict obedience and minimizes subordinate decisionmaking and initiative. Detailed command and control emphasizes vertical, linear information flow: in general, information flows up the chain of command and orders flow down. Discipline and coordination are imposed from above to ensure compliance with the plan.

In a system based on detailed command and control, the command and control process tends to move slowly: information must be fed up to the top of the chain where sole decisionmaking authority resides, and orders must filter to the bottom to be executed. Understandably, such a system does not generally react well to rapidly changing situations. Nor does it function well when the vertical flow of information is disrupted. While distrust is not an inherent feature of detailed command and control, organizations characterized by distrust tend toward detailed command and control.

This approach represents an attempt to overcome the fundamental nature of war. Since we have already concluded that precise direction is generally impossible in war, detailed command and control risks falling short of its desired result. The question is whether it nears the desired result enough to achieve overall success.

By contrast, *mission* command and control accepts the turbulence and uncertainty of war. Rather than increase the level of certainty that we seek, by mission command and control we reduce the degree of certainty that we need. Mission command and control can be described as *spontaneous*: unity of effort is not the product of conformity imposed from above but of the spontaneous cooperation of all the elements of the force.[9] Subordinates are guided not by detailed instructions and control measures but by their knowledge of the require- ments of the overall mission. In such a system, the command- er holds a loose rein, allowing subordinates significant freedom of action and requiring them to act with initiative. Discipline imposed from above is reinforced with self-discipline throughout the organization. Because it decentralizes decisionmaking authority and grants subordinates significant freedom of action, mission command and control demands more of leaders at all levels and requires rigorous training and edu- cation.

Mission command and control tends to be decentralized, informal, and flexible. Orders and plans are as brief and simple as possible, relying on subordinates to effect the necessary coordination and on the human capacity for implicit communication—mutual understanding with minimal information exchange. By decentralizing decisionmaking authority, mission command and control seeks to increase tempo and improve the ability to deal with fluid and disorderly situations.

Moreover, with its reliance on implicit communications, mission command and control is less vulnerable to disruption of the information flow than is detailed command and control.

The two approaches to the problem mark the theoretical extremes of a spectrum of command and control. (See figure 4.) In practice, no commander will rely entirely on either purely detailed or purely mission methods. Exactly what type of command and control we use in a particular situation will depend on a variety of factors, such as the nature of the action or task, the nature and capabilities of the enemy, and, perhaps most of all, the qualities of our people. This is not to suggest that the two types of command and control are of equal value and merely a matter of personal preference. While detailed command and control may be appropriate in the performance of specific tasks of a procedural or technical nature, it is less than effective in the overall conduct of military operations in an environment of uncertainty, friction, disorder, and fleeting opportunities, in which judgment, creativity, and initiative are required. Militaries have frequently favored detailed command and control, but our understanding of the true nature of war and the lessons of history points to the advantages of mission command and control.

Figure 4. The Command and control spectrum.

LEADERSHIP THEORY

Leadership is the influencing of people to work toward the accomplishment of a common objective. Because war is fundamentally a human endeavor, leadership is essential to effective command and control. There are two basic theories of leadership that generally correspond to the theories of command and control.

The authoritarian theory of leadership is based on the assumption that people naturally dislike work and will try to avoid it where possible, and that they must therefore be forced by coercion and threat of punishment to work toward the common goal. This theory further argues that people actually prefer to be directed and try to avoid responsibility. The result is an autocratic style of leadership aimed at achieving immediate and unquestioning obedience. Leaders announce their decisions and expect subordinates to execute them. The authoritarian leader is sometimes also known as a *telling* or *directing* leader. While authoritarian leadership may result in rapid obedience, it also can often result in subordinates who are highly dependent on the leader, require continuous supervision, and lack initiative. Military discipline is widely seen as an example of this model since quick and unquestioning response to orders may be required in the heat of an emergency. This is, however, only one version of leadership that military leaders have used successfully.

The opposite theory of leadership, known as persuasive or delegating leadership, assumes that work is as natural as rest or play, that people do not inherently dislike work, and that work can be either a source of satisfaction (in which case people will perform it willingly) or a source of punishment (in which case they will avoid it). This theory rejects the idea that external supervision and the threat of punishment are the most effective ways to get people to work toward the common objective. The persuasive theory argues that people will exercise initiative and self-control to the degree they are committed to the organizational objective. Under proper conditions, people learn not only to accept responsibility but to actively seek it. According to this theory, the potential for exercising imagination, ingenuity, and creativity in the solution of unit problems is widespread throughout any unit. Leadership thus becomes a question of inspiring, guiding, and supporting committed subordinates and encouraging them to perform freely within set limits. Over time, delegating or persuasive leadership tends to produce subordinates who exhibit a high degree of independence, self-discipline, and initia- tive.[10]

The leadership style we adopt in a given situation depends on a variety of factors. Key among them is the maturity of subordinates—that is, how motivated, experienced, and willing to accept responsibility they are. Here maturity is not necessarily linked to age or seniority. The more mature the subordinate, the more we can delegate; the less mature, the more we will have to direct. All other things being equal, we prefer the persuasive approach because it seeks to gain the committed performance of subordinates and encourages subordinate initiative.

Moreover, persuasive leadership reduces the need for continuous supervision, an important consideration on a dispersed and fluid battlefield on which continuous, detailed supervision is problematic.

PLANNING THEORY

Planning is the process of developing practical schemes for taking future actions. Planning may occur before a decision and so support decisionmaking—by analyzing the mission, the enemy, or the environment to help develop situational awareness or by studying the feasibility of different courses of action. Planning may also occur after a decision and so support its execution—by working out necessary coordination measures, allocation of resources, or timing and scheduling.

Planning facilitates future decisions and actions by helping commanders provide for those things which are not likely to change or which are fairly predictable (such as geography and certain aspects of supply or transport). Planning helps them to examine their assumptions, to come to a common understanding about the situation and its general direction, to anticipate possible enemy actions, and thus to consider possible counteractions. Planning helps to uncover and clarify potential opportunities and threats and to prepare for opportunities

and threats in advance. Conversely, planning helps to avoid preventable mistakes and missed opportunities.

By definition, planning is oriented on the future. It represents an effort to project our thoughts and designs forward in time and space. Because the future is always uncertain, planning should generally not seek to specify future actions with precision. The farther ahead we plan, the more time we allow ourselves to prepare, but the less certain and specific our plans can be. Planning ahead thus becomes less a matter of trying to direct events and more a matter of identifying options and possibilities.

Depending on the situation and the nature of the preparations, planning may be done rapidly or deliberately. Rapid/time-sensitive planning is conducted in response to existing conditions and is meant for immediate or near-future execution. In contrast, deliberate planning is based on anticipated future conditions and is intended for possible execution at some more distant time. We should keep in mind that all planning takes time and must facilitate the generation or maintenance of tempo, while ensuring that time allocated for planning does not adversely impact on tempo.

Planning routines can improve the proficiency of a staff by creating an effectiveness and efficiency of effort. The goal of the Marine Corps is to develop an institutionalized planning framework for use at all echelons of command. However, we must guard against using an institutionalized planning frame-

work in a lock-step fashion. We must ensure that the application of this planning process contributes to flexibility in conducting operations.

Planning occurs at different levels and manifests itself differently at these levels. At the highest level is what we can call conceptual planning which establishes aims, objectives, and intents and which involves developing tactical, opera- tional, or strategic concepts for the overall conduct of military actions. Conceptual planning should provide the foundation for all subsequent planning, which we can call functional and detailed. These are the more routine and pragmatic elements of planning which are concerned with translating the concept into a complete and practicable plan. Functional planning is concerned with the various functional areas necessary to sup- port the overall concept, such as subordinate concepts for mobilization, deployment, logistics, intelligence, and so on. Detailed planning encompasses the practical specifics of execution. Detailed planning deals primarily with scheduling, coordination, or technical matters required to move and sustain military forces, such as calculating the supplies or transport needed for a given operation.

In general, conceptual planning corresponds to the art of war, detailed planning applies to the science of war, and functional planning falls somewhere in between. Detailed and, to a lesser extent, functional planning may require deliberate and detailed calculations and may involve the development of detailed schedules or plans, such as landing tables, resupply

schedules, communications plans, or task organizations. However, the staff procedures which may be necessary in de- tailed and functional matters are generally not appropriate for broader conceptual planning. Rather, such planning should attempt to broadly influence rather than precisely direct future actions. Conceptual planning should impart intent, develop overall operating concepts, and identify contingencies and possible problems but otherwise should leave the subordinate broad latitude in the manner of functional or detailed execution.

ORGANIZATION THEORY

Organization is an important tool of command and control. How we organize can complicate or simplify the problems of execution. By task-organizing our force into capable subor- dinate elements and assigning each its own task, we also organize the overall mission into manageable parts. The organization of our force, then, should reflect the conceptual organization of the plan.

Specifically, what should organization accomplish for us? First, organization establishes the chain of command and the command and support relationships within the force. The chain of command establishes authority and responsibility in an unbroken succession directly from one commander to an- other.

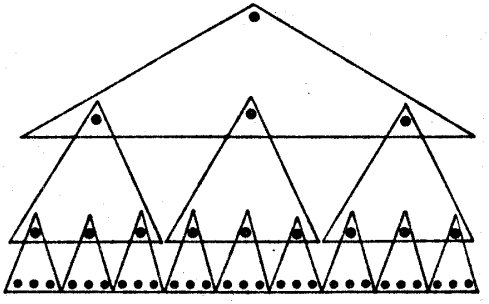
The commander at each level responds to orders and directions received from a higher commander and, in turn, issues orders and gives directions to subordinates. In this way, the chain of command fixes authority and responsibility at each level while at the same time distributing them broadly throughout the force; each commander has designated authority and responsibility in a given sphere. Command and support relationships specify the type and degree of authority one commander has over another and the type and degree of support that one commander provides another.

Importantly, organization should establish unity of command which means that any given mission falls within the authority and responsibility of a single commander and that a commander receives orders from only one superior for any given mission. Similarly, organization should ensure that a commander has authority over or access to all the resources required to accomplish the assigned mission.

Organization also serves the important socializing function of providing sources of group identity for members of the organization. For example, Marines may see themselves first as members of a squad, next as members of a platoon, and then as members of a company. An organization operates most effectively when its members think of themselves as belonging to one or more groups characterized by high levels of loyalty, cooperation, morale, and commitment to the group mission.

Each commander (supported by the staff) and immediate subordinates constitute an integrated team—a cohesive group committed to the accomplishment of a single mission. For example, a company commander and platoon commanders constitute a team cooperating in the accomplishment of the company mission. A platoon commander and squad leaders also constitute a team cooperating in the accomplishment of the platoon mission. The size of a team can vary with the situation, as we will discuss. Whereas the chain of command conveys authority and responsibility from commander to commander, the idea of an integrated team is to pull individuals together into cohesive groups. (See figure 5.) Each team functions as a single, self-contained organism—characterized by cooperation, reciprocal influence, lateral and vertical communication, and action-feedback loops operating continuously in all directions. Each member of the team may perform a different task, but always within the context of the team mission. Continuity throughout the organization results from each commander's being a member of two related teams, one as the senior and one as a subordinate.[11]

Organization should also provide commanders with staffs appropriate to the level of command. The staff assists the commander by providing specialized expertise and allowing a division of labor and a distribution of information. The staff is not part of the chain of command and thus has no formal authority in its own right, although commanders may delegate authority to a staff officer if they choose.



△ = An integrated team, a cohesive group consisting of a commander (and by association his staff) and his immediate subordinates who work together toward the accomplishment of a common goal. The size of each team will depend on circumstances. All teams shown here in triangles are four persons.

Continuity is provided by the fact that each commander is a member of two related teams, one as the senior and one as a subordinate. Through this overlapping structure, the commander is able to extend his command over the entire force.

Figure 5. Overlapping units and teams.

Organization should ensure a reasonable span of control which refers to the number of subordinates or activities under a single commander. The span of control should not exceed a commander's capability to command effectively. The optimal number of subordinates is situation-dependent. For example,

the more fluid and faster-changing a situation is, the fewer subordinate elements a commander can keep track of continuously. Likewise, commanders exercising detailed command and control, which requires them to pay close attention to the operations of each subordinate element, generally have narrower spans of control than commanders who use mission command and control and let their subordinates work out the details of execution.

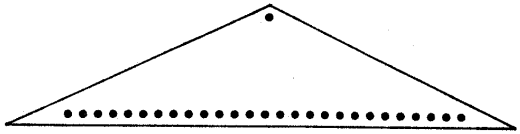
Although a reasonable span of control varies with the situation, as a rule of thumb an individual can effectively command at least three and as many as seven subordinates. Within this situation-dependent range, a greater number means greater flexibility—three subordinate units allow for more options and combinations than two, for example. However, as the number increases, at some point we lose the ability to effectively consider each unit individually and begin to think of the units together as a single, inflexible mass. At this point, the only way to reintroduce flexibility is to group elements together into a smaller number of parts, thereby creating the need for another intermediate echelon of command. The evolution of the Marine rifle squad during the Second World War is a good example of this. Entering the war, the rifle squad consisted of nine Marines—a squad leader and eight squad members with no additional internal organization. In combat this squad lacked the flexibility needed for small-unit fire and maneuver. Moreover, squad leaders often could not effectively command eight individual Marines. The answer was the creation of an intermediate organizational level, the fire team of four Marines, which

also allowed an increase in squad size to thirteen Marines. The creation of the fire team decreased the number of immediate subordinates the squad leader had to deal with, while extending the squad leader's influence over a larger squad.

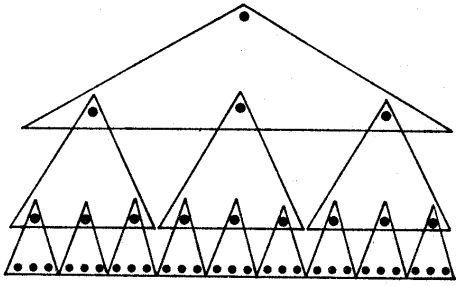
Narrowing span of control—that is, lessening the number of immediate subordinates—means deepening the organization by adding layers of command. But the more layers of command an organization has, the longer it takes for information to move up or down. Consequently, the organization becomes slower and less responsive. Conversely, an effort to increase tempo by eliminating echelons of command, or flattening an organization, necessitates widening the span of control. The commander will have to resolve the resulting tension that exists between organizational width and depth. (See figure 6.)

Finally, organization does not apply only to people and equipment. It also applies to information. In large part, organization determines how we distribute information throughout the force and establishes communication channels.

Information may flow vertically within the chain of command, but it should not be restricted by the chain of command. It also flows laterally between adjacent units, or even "diagonally"—between a platoon and an adjacent company headquarters, for example, or between a supported unit and a supporting unit outside the chain of command. Information



Example of an extremely "flat" organization with "wide" span of control; direct link between top and bottom.



Example of the same unit organized "deeper" with "narrower" spans of control; never more than three "wide"; two intermediate echelons between top and bottom.

Figure 6. Organization width and depth.

flows informally and unofficially—that is, between individuals according to personal relationships—as well as according to formally established channels. These informal channels provide an important redundancy and are especially important in team building.

COMMUNICATIONS THEORY

Because military evolutions require cooperative effort, it is important that we be able to communicate effectively with others. Communications are any method or means of conveying information from one person or place to another to improve understanding. In general, effective organizations are characterized by intense, unconstrained communications— that is, the free and enthusiastic sharing of meaningful information throughout the organization.[12] Moreover, communication has an importance far beyond the exchange of information; it serves a socializing function. Separate from the quality or meaning of the information exchanged, the act of communicating strengthens bonds within an organization and so is an important device in building trust, cooperation, cohesion, and mutual understanding.

The traditional view of communications within military organizations is that the subordinate supplies the commander with information about the situation, and the commander in turn supplies the subordinate with decisions and instructions. This linear form of communication may be consistent with the exercise of detailed command and control, but not with a system based on mission command and control which instead requires interactive communications characterized by continuous feedback loops. Feedback provides the means to improve and confirm mutual understanding—and this applies to lateral as well as vertical communications.

We communicate by a wide variety of means: face-to-face conversation, radio, telephone, data link, written word, visual signal, picture, or diagram. Human beings communicate not only in the words they use, but also by tone of voice, inflection, facial expression, body language, and gestures. In fact, evidence suggests that in face-to-face conversation, humans actually communicate most by visual means (such as gestures, body language, or facial expressions), second by vocal nonverbal means (such as tone or inflection), and least by the actual words they use.[13]

Moreover, people can communicate implicitly—that is, they achieve mutual understanding and cooperation with a minimal amount of information having to be transmitted—if they have a familiarity formed of shared experiences and a common outlook. A key phrase or a slight gesture can sometimes communicate more than a detailed order. Since it reduces the time spent drafting and relaying messages, implicit communication also reduces the problems of delay typically associated with information flow. Implicit communication helps to maximize information content while minimizing the actual flow of data, thereby making the organization less vulnerable to the disruption of communications.

While conciseness is a virtue, so is a certain amount of redundancy. Used within reason, redundancy of communications can improve clarity of meaning and mitigate against disruptions to the communications system. Effective commu- nications consequently exhibit a balance between conciseness and

redundancy. (In general, the greater the implicit understanding within the organization, the less the need for redun- dancy.)

INFORMATION MANAGEMENT THEORY

Since effective command and control is concerned with getting the right information to the right person at the right time, information management is crucial.

We initiate communications under two basic principles: *supply-push* and *demand-pull*.[14] A supply-push system pushes information from the source to the user either as the information becomes available or according to a schedule. (See figure 7.) The advantages of supply-push are that the commander does not need to request the information and that the information generally arrives in a timely fashion. The challenge with a supply-push system is to be able to anticipate the commander's information needs. The danger of information overload arises primarily from supply-push.

By contrast, a pure demand-pull system does not rely on the ability to anticipate information needs; it is inactive until a demand is made on it. In a pure demand-pull system, the user generates all information requirements. (See figure 7.) If the information is readily available—already resident in some

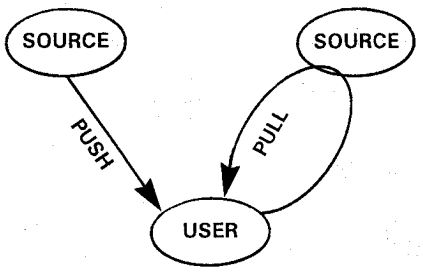


Figure 7. Supply-push and demand-pull information management.

data base, for example—the demand can be filled quickly and efficiently. However, if the information is not readily available, the demand typically triggers a "demand cascade," as the requirement filters through the chain of command until it reaches the appropriate level for gathering. This takes time and can be a burden to lower echelons, especially in a centralized command and control system in which all information must be fed to the senior echelons. An answer to the demand cascade is for commanders to keep dedicated gathering assets which answer directly to them, such as the directed telescopes already mentioned.

Demand-pull can help focus scarce resources on those tasks which the commander has identified as critical; it can deliver information specifically tailored to the commander's information needs; and it will produce only that information which the

commander requests. These characteristics can be both strengths and weaknesses. They can be strengths because information flow is tailored specifically to identified requirements. However, they can also be weaknesses because there will often be information requirements that the commander has not identified, and in a pure demand-pull system those requirements will go unsatisfied. One definite disadvantage of demand-pull is the cost in time since the search for information may not begin until the commander has identified the need for that information.

We can also discuss information management in terms of how information is transmitted. First, information may be broadcast, sent simultaneously to a broad audience—anyone with access to the information network—to include different echelons of command. (See figure 8.) The great advantage of broadcast is that it gets information to the widest audience in the shortest amount of time. If the information is of a generic nature, this method may be extremely efficient. However, since the information is sent to a wide audience with varying information requirements, the information cannot be tailored to suit any specific commander's needs. Perhaps the greatest drawback of broadcast transmission is that undisciplined use of this method can quickly lead to information overload.

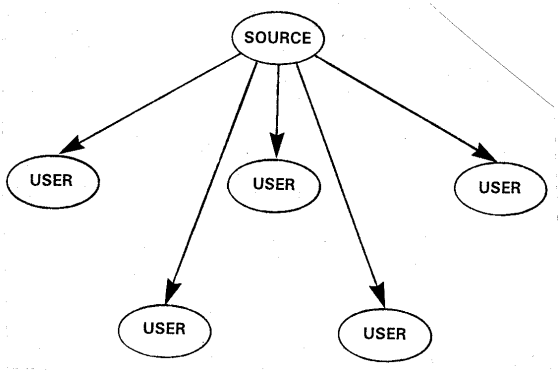


Figure 8. Broadcast transmission.

The alternative to broadcast is point-to-point transmission—or "narrowcast"—in which information is sent to a specific user or users. As appropriate, information is then passed sequentially from one user to the next. (See figure 9.) Point-to-point transmission has two basic advantages. First, information can be tailored to meet the specific needs of each recipient. Second, point-to-point transmission has built-in control mechanisms which broadcast transmission lacks. Each node in the sequence can serve as a control mechanism, filtering and integrating information as appropriate before passing it on—lessening the risk of overload and tailoring information to the needs of the next recipient. The major disad-

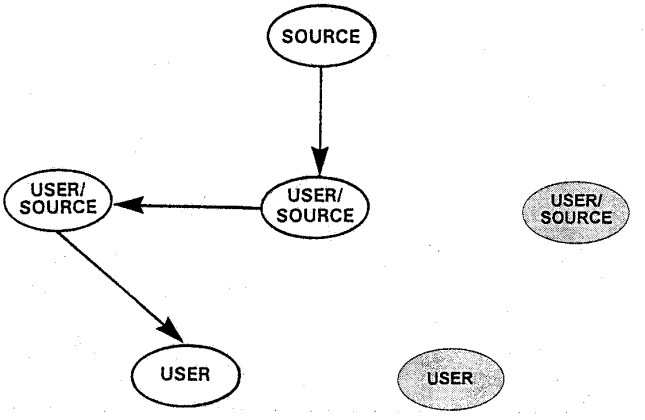


Figure 9. Point-to-point transmission.

vantages of point-to-point are that information reaches a broad audience more slowly and that the chances of distortion increase with each node that information passes through.

In practice, the different aspects of information management are far from incompatible; in fact, combined wisely they can effectively complement one another within the same command and control system.

DECISIONMAKING THEORY

A principal aim of command and control is to enhance the commander's ability to make sound and timely decisions. As we might expect, the defining features of command and control—uncertainty and time—exert a significant influence on decisionmaking.[15] All decisions must be made in the face of uncertainty. Theoretically, we can reduce uncertainty by gaining more information, but any such decrease in uncertainty occurs at the expense of time. And as we have already mentioned, it is not so much the amount of information that matters, but the right elements of information available at the right time and place.

There are two basic theories on how we make decisions.[16] The traditional view is that decisionmaking is an analytical process based on generating several different options, comparing all the options according to some set of criteria, and identifying the best option. The basic idea is that comparing multiple options concurrently will produce the optimal solution. As a result, analytical decisionmaking tends to be methodical and time-consuming. Theoretically, reasoning power matters more than experience.

The other basic approach, called intuitive decisionmaking, rejects the computational approach of the analytical method and instead relies on an experienced commander's (and

staff's) intuitive ability to recognize the key elements of a particular problem and arrive at the proper decision. Intuitive decisionmaking thus replaces methodical analysis with an intuitive skill for pattern-recognition based on experience and judgment. The intuitive approach focuses on situation assessment instead of on the comparison of multiple options. Intuitive decisionmaking aims at "satisficing," finding the first solution which will satisfactorily solve the problem, rather than on optimizing, as the analytical approach attempts to do.[17] The intuitive approach is based on the belief that, war being ultimately an art rather than a science, there is no absolutely right answer to any problem. Intuitive decisionmaking works on the further belief that, due to the judgment gained by experience, training, and reflection, the commander will generate a workable first solution, and therefore it is not necessary to generate multiple options. Because it does not involve comparing multiple options, intuitive decisionmaking is generally much faster than analytical decisionmaking. If time permits, the commander may further evaluate this decision; if it proves defective, the commander moves on to the next reasonable solution.

Each approach has different strengths and weaknesses, and determining which approach is better in a given situation depends on the nature of the situation, particularly on how much time and information are available. The analytical approach may be appropriate for prehostility decisions about mobilization or contingency planning when time is not a factor and extensive information can be gathered. It may be useful in

situations in which it is necessary to document or justify a decision or in decisions requiring complicated computations which simply cannot be done intuitively (such as in making decisions about supply rates). It may be appropriate when choosing from among several existing alternatives, as in equipment acquisition, for example. Finally, an analytical approach may have some merit in situations in which commanders are inexperienced or in which they face never-be- fore-experienced problems. However, that said, the intuitive approach is more appropriate for the vast majority of typical tactical or operational decisions—decisions made in the fluid, rapidly changing conditions of war when time and uncertainty are critical factors, and creativity is a desirable trait.[18]

We frequently associate intuitive decisionmaking with rapid/time-sensitive planning and analytical decisionmaking with deliberate planning. This may often be the case but not necessarily. For example, a thorough, deliberate planning effort in advance of a crisis can provide the situational awareness that allows a commander to exercise effective intuitive decisionmaking. Conversely, the analytical approach of developing and selecting from several courses of action may be done rapidly. The point is that the planning model or process we choose, and the decisionmaking approach that supports it, should be based upon the situation, the time available, the knowledge and situational awareness of the organization, and the commander's involvement in the planning and decisionmaking process. While the two approaches to decisionmaking are conceptually distinct, they are rarely mutually exclusive in

practice.

CONCLUSION

Our view of the true nature of war leads us to one of two responses to dealing with the fundamental problem of command: either pursuing certainty or coping with uncertainty. These responses lead to two distinctly different theories of command and control. Each theory in turn imposes its own requirements on the various aspects of command and control—decisionmaking, communications, information management, planning, organization, training, education, doctrine, and so on—and so forms the basis for a distinct and comprehensive approach to command and control. The question is: Which approach do we adopt? The Marine Corps' concept of command and control is based on accepting uncertainty as an undeniable fact and being able to operate effectively despite it. The Marine Corps' command and control system is thus built around mission command and control which allows us to create tempo, flexibility, and the ability to exploit opportunities but which also requires us to decentralize and rely on low-level initiative. In the next chapter, we will discuss the features of such a command and control system.