Zeitschrift: ASMZ : Sicherheit Schweiz : Allgemeine schweizerische Militärzeitschrift

Herausgeber: Schweizerische Offiziersgesellschaft

Band: 170 (2004)

Heft: 12

Artikel: The art of targeting : a comparison of thwo fundamental theoretical conceptions

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DOI: https://doi.org/10.5169/seals-69342

The Art of Targeting

A Comparison of Two Fundamental Theoretical Conceptions

When it comes to the employment of air power to attain political objectives in war, two major schools of thought can be discerned. There are those who argue in favour of a quick decisive blow against targets of higher strategic order and those who prefer the employment of air power against the opponent's fielded forces.

These two competing conceptions have found practical expression in actual campaigns over the last couple of years. In the air campaign over Kosovo and Serbia in 1999, the Supreme Allied Commander Europe, General Wesley Clark (US Army), supported an air campaign which was directed against Serbian ground forces operating in Kosovo. On the other hand, the Commander of Allied Air Forces in Europe, General Michael Short (USAF), regretted that air strikes had not been aimed against leadership targets in Belgrade from the outset. This dichotomy was also apparent in Operation Iraqi Freedom. The air war started with a 'Shock and Awe Campaign' against leadership facilities in Baghdad. After these initial strategic strikes, the emphasis was shifted towards the Republican Guard divisions in order to soften them up for the advancing Army and Marine units.[1]

The theoretical conceptions of these opposing schools of thought are brilliantly encapsulated in the writings of Colonel John A. Warden III and of Robert A. Pape. The former is a strong supporter of strategic strikes, which are aimed at paralysing the opponent's 'system', whereas the latter sees the true value of air power in a joint campaign against an opponent's forces in the field. John Warden has specifically prepared the article 'Strategy and System Thinking in War' for the Swiss Armed Forces Air Power Review and Robert Pape has kindly allowed the re-use of his recent Foreign Affairs article 'The True Worth of Air Power'.[2]

Very soon after the Iraqi invasion of Kuwait, Colonel John Warden briefed General Schwarzkopf on how to best utilise air power against Iraq, by presenting him an operational plan called 'Operation Instant Thunder'. In his autobiography, General Schwarzkopf mentions: 'Warden had come up with a strategy designed to cripple Iraq's military without laying waste to the country'.[3] Although the name of the plan changed and there were several refinements to the original outline, the initial August presentation was the basis of the January air campaign. How could John Warden come up with an operational plan so quickly? In the years prior to the Gulf War, he had devoted himself to the question on how to employ air power most effectively on an operational level. As a student at the National War College (1985–1986), John Warden wrote his book 'The Air Campaign', in which he laid the foundation for his well-known 'Five Rings' concept. A major catalyst for his air power thinking and concepts was certainly his tour in Vietnam, where he flew 266 combat missions as an OV-10 pilot and forward air controller (1969–1970). He was involved in close air support missions with the Army 1st Air Cavalry Division as well as interdiction missions over the Ho Chi Minh Trail. As a result of his experiences, John Warden is very critical of the conduct of air operations in the Vietnam War. It was clear to him that air power had not been properly utilised. During his post-Vietnam military career, John Warden was in command of an F-15 Fighter Wing at Bitburg Air Base, Germany (1986–1988). After the Gulf War, he became special assistant to the Vice President of the United States (1991–1992) and Commandant of the Air Command and Staff College (1992–1995). Following his retirement from the USAF in 1995, he founded a consultancy company and developed a new approach to combining business and war strategy.[4] With regards to the employment of air power, John Warden's main argument is that we should not stop expanding the frontiers and operational utility of air power. Recent experience has shown, however, that the West has been too easily dragged into confrontations on the ground, into what is often considered to be the Achilles' heel of the West.[5]

In contrast, Robert Pape is an Associate Professor of Political Science at the University of Chicago. He has always had a deep interest in national security affairs. In the 1980s, Robert Pape was drawn to the study of air power, developing a keen interest in understanding America's failure in Vietnam. He quickly discovered that air power was a key part of the story. According to him, a reason why it was hard to understand air power's failure in the Johnson years was that there was no systematic study of all major strategic air campaigns that would serve as a baseline to understand Vietnam. Hence, he set out to conduct such a study, writing his dissertation 'Coercive Air Power' in 1988 and expanding and extending that study in his book 'Bombing to Win' in 1996. Though Robert Pape has shifted the emphasis of his research to other areas of national security, such as economic sanctions and suicide terrorism, in recent years, he still retains a strong interest in what makes air power work. The reason for this is simple: it is only by understanding what air power can and, just as important, cannot achieve that we can avoid the overconfidence that has often led to the failure of coercive air power in the past.[6] Robert Pape argues that many air power practitioners in the West have misunderstood the true value of precision-guided munitions (PGM) in the wake of Desert Storm. It is widely believed that PGMs enable the United States to win wars within just days, by targeting the enemy leadership. Robert Pape, however, argues that the true value of PGMs lies in the support of ground power. They have rendered joint operations between air and ground forces in conventional campaigns so much more effective that air power is now doing most of the work.

The intention of the following two papers is to illustrate this fundamental debate on the correct employment of air power and to stimulate a fruitful debate on the use of air power. The two basic texts are John Warden's 'The Air Campaign' (translated into at least seven languages) and Robert Pape's 'Bombing to Win'.[7] 'The Air Campaign' served as the conceptual basis of the opening air operations against Iraq in 1991. 'Bombing to Win' has been widely discussed and has attracted considerable attention by both scholars and practitioners of air power alike. It unleashed a heated debate in the academic journal 'Security Studies'.[8]

Christian F. Anrig

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[1] Air Component Commander of Operation Iraqi Freedom, General T M 'Buzz' Moseley (USAF) at the RAF Defence Studies Conference 'Iraq 2003: Air Power Pointers for the Future', RAF Museum Hendon, 11 May 2004.

[2] First published March/April 2004, Vol. 83, No. 2, pp. 116–130.

[3] General H. Norman Schwarzkopf & Peter Petre, *The Autobiography: It doesn't take a Hero* (New York, London: Linda Grey Bantam Books, 1992), p. 318.

[4] The Prometheus Process, for further information see www.venturist.com.

[5] E-Mail from John A. Warden, 27 June 2004.

[6] E-Mail from Robert A. Pape, 29 July 2004.

[7] John A. Warden III, *The Air Campaign: Planning for Combat*, rev. ed. (San Jose/New York/Lincoln/ Shanghai: toExcel, 2000), first published in 1986, and Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (Ithaca/London: Cornell University Press, 1996).

[8] *Security Studies*, Vol. 7, No. 2, Winter 1997/98, pp. 93–214.

Strategy and System Thinking in War

John A. Warden III*

Strategy is complex at the detail level, but at its most basic level, it is simple. It is so simple that we can reduce it to four simple words: Where (are we going); What (should we put our resources against); How (are we going to apply our resources); and Exit (plans for every war, campaign, individual, action, phase, and weapon).

These four components – where are you going, against what do you put your resources, how do you apply your resources, and what is the manner of exiting from every strategic and tactical phase – underlie strategy.

These four components – where are you going, against what do you put your resources, how do you apply your resources, and what is the manner of exiting from every strategic and tactical phase – underlie strategy. If you do not address each one, you are not being strategic and you are likely to pay dearly for the omission. In the system I used in the first Gulf War and subsequently expanded and applied in the business world, the four questions turn into four imperatives: I – Design the Future; II – Target to Win; III – Campaign for Success; and IV – Finish with Finesse.

- Imperative I – Design the Future. Good planning should always start with the future, and in war, it is vital to do so. In essence, before we become involved in a war, we decide what we want our future and our enemy's future to look like at some point after the end of the war and its transition into a new state of peace. It might be surprising that war planning looks first at your own future, but the reason is simple. From your standpoint, your future is paramount, not your enemy's. You need to know what you want your future to be from an economic, power position, and internal political situation. Once you have clearly charted your own future, you can craft a future for your enemy. In both cases, you must craft clear measures that tell you when you are achieving your future and these measures must be strategic, not tactical.[9] Always remember to keep your own future picture as your priority; it little behooves you to defeat your enemy only to find that you have destroyed your own country in the process.
- II – Target for Success. This imperative is based on a thorough understanding of the enemy as a system which we will discuss in detail later in this article. The overall thrust is simple: You never have enough resources to do everything; effort and resources must be applied against something – targets; failure to choose the right "targets" dooms operations before they begin; the right "targets" are the key to creating the effects needed for sustained success and realization of the future you have designed; and the right "targets" are part of a system.
- III – Campaign to Win. This imperative tells you to conduct your operations in campaigns that facilitate parallel attack on your enemy. Parallel attack means bringing the right targets under as near simultaneous attack as possible in order to induce paralysis. Parallel attack is the opposite of serial attack where you strike one or just a few targets at a time. Parallel attack precludes competent enemy system response whereas serial attack allows it, and to some extent actually induces it.
- IV – Finish with Finesse. This imperative addresses what is typically the most dangerous, most expensive, most poorly thought out aspect of war operations – the end game. End-game planning in war and business should be taken at least as seriously as initiation planning, and probably even more seriously. Everyone has some experience with starting something, but not many have rigorous experience with ending activities profitably.

The object of war is to change your enemy to be compatible with your own objectives at an acceptable cost. The degree of change can range from your enemy agreeing not to destroy you to the annihilation of your opponent. Most wars are fought for change that falls in the middle half of the range.

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To resist the changes that we might want to impose on an enemy, the enemy must have energy. At the highest level of system thinking, enemy energy (for offense or defense) is a function of just two things: physical and psychological (or "moral" in older parlance). The physical side of the enemy consists of tangibles like people, buildings, communications systems, and weapons. The psychological side consists of intangibles like will, morale, and attitudes. In system war, however, we are not so much concerned with the psychology of an individual (although that can be quite important), but rather with the psychology of the system as a whole. The following equation captures the concept:

$$Energy_{Enemy} = f(physical) \times f(psychological)$$

This equation is enormously useful for thinking about war operations (and any other, for that matter). It tells us that if either the physical or the psychological are 0, the enemy is frozen and unable to attack or defend. A little thought proves the point: the most powerful entity in the world cannot be successful in war if that entity has no will to attack or defend; conversely, the most determined, most aggressive entity cannot be successful if it has no physical assets.[10]

When we go to war, we want to have as high a probability of success as possible (and at the lowest possible cost). Our probability of success is a function of what we do to the enemy and the time period in which it is done. The following equation is similar to where we started, but now we look at probability of success which has a time function in it

$$P_S = \frac{\Delta(Energy)}{Time}$$

This equation tells us that our probability of success in changing an enemy goes up as we decrease his energy and decrease the time that we take to do it.

With these basic ideas established, let us now take a macro look at the two components of enemy energy – the physical and the psychological. The first is theoretically entirely knowable. That is, with perfect intelligence, we could be aware of every physical thing in an enemy entity that contributed to its capability as a system. In other words, physical things are determinate and in the aggregate, they generally don't change much over short time frames (hours, days, or weeks). On the other hand, the system psychological side of the equation is only slightly knowable. The system psychological side is thus indeterminate and can change dramatically in very short

*All graphs by John A. Warden.

[9] For a full description of this strategy process, see my book, Winning in FastTime, Venturist Publishing, 2002.

[10] Take for example an entity like Al Qaida. If all it had was the strong desire to kill non-believers, it would be little more than an academic curiosity and its P, of changing its opponents would be 0. Only when it acquires physical capabilities like money, communications, pamphlets, schools, pilots, and stolen aircraft can it raise its P, above 0. Note that an entity only needs to have physical assets at its disposal; it does not need to own them in the way that most nations own their physical assets.

time frames (seconds to minutes). To confirm this assertion, think about how impossible it is to predict the psychology of a group of people. One second they are a collection of nice, docile people and the next they are a stampeding mob – but an apparently identical group of people, presented with the same stimuli, do not become a stampeding mob.

Think about how impossible it is to predict the psychology of a group of people.

It is very important in war to understand the indeterminateness of the psychological side of the equation. If you are betting your success on changing this side of the equation, you are betting on the indeterminate, the unknowable, and the unpredictable. That is why war theories like coercion and deterrence are on shaky ground from the start. Both depend on your enemy deciding to act or not act out of concern for the consequences and costs experienced or anticipated. We know, however, from the study of crowds (politicians, investors, speculators, mobs) that what is a concern and a fear today may be a motivator tomorrow. For example, after the fact, some critics of strategic bombing said that enemy bombing strengthened the system psychological side of the equation (raised morale) in both Germany and England during World War II. Before the fact, nobody had predicted that bombing would raise morale; the generally accepted view was just the opposite.

Coercion is a war theory that does not stand the test of common sense.

In the actual event, bombing drove morale down in both cases but not to the point of collapse. Nobody had predicted this outcome which is good illustration of the difficulty of predicting system psychological effects. On the other hand, the decision of the Iranians to agree to a truce with Iraq in 1988 flowed in part from the fall in system morale induced by Iraq's strategic air and rocket attacks on Iran. Strangely, however, the fall in system psychological morale that contributed to Iran's decision to accept a cease-fire, apparently had little impact on support for the clerical leaders of the country.

Coercion is a war theory that does not stand the test of common sense. To coerce someone means to get them to agree to do something because you have hurt them or threatened to hurt them. Again, for this to work, it depends on making changes on the indeterminate system psychological side of the equation. Some people (and some nations) may make dramatic concessions at the hint of a threat while others will die before they give as much as an inch. To compound the problem, the people or nation that today will accede to the slightest threat may tomorrow move to the opposite camp, and vice versa.

If both factors in the enemy energy equation were equally unknowable and indeterminate, war would be a throw of the dice. Fortunately for those who think through the problem, it is possible to reduce risk levels and make reasonable predictions about war outcomes. To do, however, it is necessary to focus on the physical part of the enemy energy equation and to think about the enemy as a system. When you understand the enemy as a system, it becomes possible to craft operations that give you the highest possible probability of success for the resources you are willing and able to commit. Very simply, you change the enemy's physical system to match your desires. Useful to note at this point is that we can apply the concept of system change to an enemy state, a terrorist organization like Al Qaida, to an enemy army or air force, or to an enemy unit like a corps or a wing. If an enemy leader decides to negotiate before you have completed the system change, so much the better. The rule is, however, to plan on predictable system change and to treat good system psychological outcomes as a welcome, but unpredictable bonus. Reversing the process – trying for psychological outcomes like coercion or deterrence – puts you in great peril.

In the original Gulf War air campaign planning, we tried to follow the idea of focusing on the physical as the primary method of achieving our objectives. In our first presentation to General Schwarzkopf on 10 August 1999, however, I used a briefing slide that stated that our proposed strategic psychological operations were as important as the bombing operations.[11] The reason for this was simple: it would have benefited our post-war position significantly to have seen a change of regime in Iraq. It was not necessary for victory but it would have been very good. Because of the unpredictability of system psychology, it was possible that the Iraqis would remain loyal to Saddam Hussein regardless of what happened to their country. The purpose of the proposed strategic psychological operations was to induce elements within Iraq to overthrow Saddam, but again, doing so was not necessary to achieve the basic war objectives.[12] General Schwarzkopf agreed with this idea but asked what the result would be if we did not get Saddam (or see him overthrown). I answered that it would be too bad for everyone concerned, but that it would not make too much difference overall; what we planned to do Iraq as a system would mean it would be at least a decade before Iraq could be a strategic threat to its neighbors. General Schwarzkopf replied that if we could get a decade for what we believed would be a very low cost war, he would be delighted.

Lets review, our equation:

$$\text{Energy}_{\text{Enemy}} = f(\text{physical}) \times f(\text{psychological})$$

We should place our emphasis on the physical side because it is determinate and we can be fairly sure of what will happen if our operations are successful. The same is not true with the system psychological side because it is indeterminate. If, however, we begin operations designed to force physical change, it makes perfect sense to operate also against the system psychological side – if we have the resources. There may be some cases where you can do nothing against the physical side of your opponent. In this case, you might use psychological operations alone, in lieu of doing nothing. We just need to accept the fact that we cannot predict what will happen which is why we should never make deterrence, coercion, decapitation alone, psychological operations alone, or other similar mind-based concepts the heart of our operations.

We should place our emphasis on the physical side because it is determinate and we can be fairly sure of what will happen if our operations are successful.

[11] In retrospect, I believe I overstated the importance of the strategic psychological operations – which were not executed for a variety of reasons. I believe that if they had been executed as proposed, that Saddam would have been overthrown – which would have been good for Iraq and the world. But since his overthrow was not essential, it was not logical to say that the strategic psychological operations were as important as the bombing operations. It would have been far more correct to have said that the strategic psychological operations had the possibility of achieving significant results for very little cost and that it would be a huge error not to try them – as long as we kept in mind that they were unpredictable and had to be subordinate to the physical operations.

[12] In simple form there were four objectives: Iraq out of Kuwait; restoration of the Kuwaiti government; safety for Americans in the area; and a more stable region (meaning a less powerful Iraq).

Imperative II: Target for Success and the Enemy as a System

Targets are not things unto themselves; rather, they are part of a system. Everything is part of a system, and every action takes place in a system. That means that affecting one target will have some impact on other targets. What we really want, however, is to make a major change in an entire system. In the 1991 Gulf War, we wanted to reduce Iraq's energy level to a point where it would no longer constitute a strategic threat to its neighbors but could still defend itself against local powers. When we want to change an organization, we want the whole organization to move in the same direction. All this says that our efforts are always focused against systems and that we then choose the targets that will create the fastest, most long-lasting, most economical, most satisfactory system change.

Systems have certain common characteristics that include: a collection of disparate elements with mutual interaction; information flow across the system to its elements; at least a minimum amount of energy; inertia and change resistance; exhibit the hysteresis effect; centers of gravity (as already noted); and similar patterns of organization. Let's look in more detail at several of these characteristics.

Systems, whether they be nations, companies, universities, or families resist change and exhibit the hysteresis effect. We know that systems always resist even the idea of change. Thus, if we do something to any system – drop a bomb on a country, throw a new product into a market, introduce a new theory to a university department – it will respond by opposing the something, by trying to stop it, by acting to negate its effect. We should never be surprised when systems act this way; indeed, we should be amazed if they did not.

Systems, whether they be nations, companies, universities, or families resist change and exhibit the hysteresis effect.

We have all had the experience of working with a group of people to teach them something new. After a long time, we believe they have learned the new procedure and that we can put our efforts elsewhere. Much to our dismay, however, when we return to our group a few weeks later, we find that it has returned to its old ways. This is an example of the hysteresis effect, a term from mechanics that describes how material under a deforming force will tend to return to approximately its original state when the deforming force stops. It will always do this – unless you exceed its elastic limits. When you work with systems, the objective is normally to exceed the elastic limits (either positively or negatively depending on the situation) so that the system stays where you want it without further expenditure of effort on your part.

When you look at an enemy, whether a large entity like Iraq or a more dispersed entity like an Al Qaida, you are likely to be overwhelmed with the number of targets and conclude that you have inadequate resources and that defeat of the enemy is too hard. Intuitively, however, you know that out of those hundreds of thousands of possible targets, some small number would be far more important and valuable than the rest. Even in a large and powerful country, there are relatively few really important targets (perhaps a thousand). These we call centers of gravity because when they are affected, they have a disproportionate impact on the rest of the system. We might also think about them as leverage points or control points.

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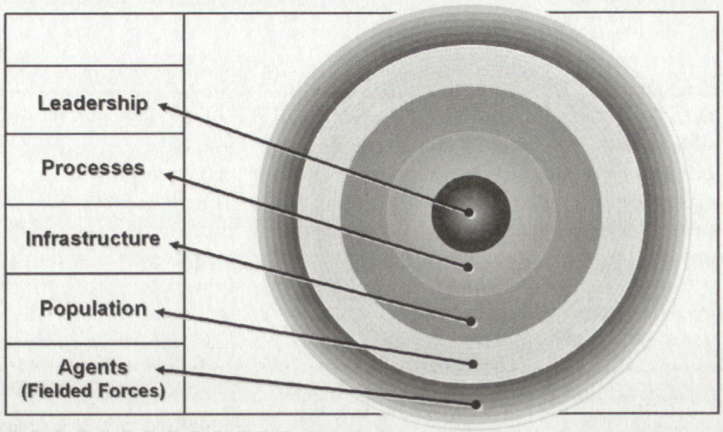
Centers of gravity are the things against which you should apply your resources. It makes little sense to spend scarce resources against anything other than centers of gravity, yet the majority of planners in both the military and the commercial world spend little or no time identifying them. Instead, they rush to action thinking that if they do a lot of anything, something positive is bound to happen. Worse yet, if the planners are military, they are likely only to think about attacking their enemy military counterparts. For the very lucky or for those with infinite resources, something positive may indeed happen. If you don't include yourself in either of these groups – the very lucky or the infinitely wealthy – you should be spending a lot of time on thinking about centers of gravity.

System Components



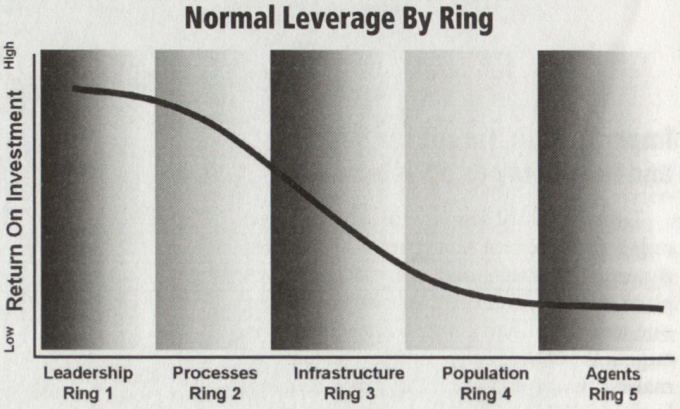
The mathematicians Barabási and Bonabeau[13] recently derived the relationship between nodes and the number of links connecting the nodes in a system like the Internet. There are a very small number of nodes that have many links and a very large number of nodes that only have one or two. If you want to affect a system like the Internet, you obviously get far more leverage if you find and affect the nodes with lots of links than the ones with only one or two links. The reason is simple: when something positive or negative happens to a node with multiple links, the effect spreads to some degree to all the other nodes to which it is linked. Conversely, when something happens to a node with just one link, the system hardly notices that anything has happened. A good way to think about centers of gravity is to think in terms of the number of links they have.

To reiterate the crucial concept of centers of gravity: they are those few things in a system which have disproportionate impact on the system. They are the leverage points in the system. When you put your energy against centers of gravity, you see more system change than if you put the same amount of energy against something in the system that was not a center of gravity. If your resources are limited, you need to find and address centers of gravity if you are to hope for success.

Knowing that there are centers of gravity is the first step toward effective and efficient operations, but we need a methodology to help us figure out how to find the true centers of gravity. The approach that I have found most useful in war, politics, education, and business is the Five Rings Model which we will address in detail after a little more discussion on systems.

A very important characteristic of systems is that they all are arranged in the same way. They all have leadership elements which provide general direction, process

[13] For more detail see Scientific American magazine, May 2003, page 60.



elements[14] which convert energy from one form to another, a physical infrastructure, a population consisting of some number of demographic groups, and agents – otherwise known as "fielded forces"[15] who are responsible for the tactical actions of the system. By knowing that all systems are arranged this way, we know what to look for when we start analyzing a particular system, be it a country, a terrorist organization, a market, a company, an army corps, or even a criminal gang. We also know that in general, we will get more return on our energy when we apply it toward the center of the system than when we apply it on the periphery. Thus, we always start our thinking from the inside to the outside instead of the much more common – and erroneous – outside to the inside approach. Now let's look at each of the rings in more detail.

Ring 1, Leadership: The leadership ring consists of those elements of a system that try to move it in a particular direction. There are almost always several leadership elements that rarely have the same motivations, are relatively autonomous, may not have formal titles, may be individuals or entities, and almost always provide very high leverage. Who we include in the leadership ring depends on the level of the system we are analyzing. If we were looking at a nation, we would find heads of state, prime ministers, influential cabinet ministers, senior military officers (if they are independently influential at a national level), the key influential newspapers and television stations, the legislative body, nationally influential financiers, well-known clerics (in some countries but not in others), important opposition leaders, and perhaps some think tanks. If we were looking at a military unit like a division, we would see the commander, informal leaders, and probably the staff.

Ring 2, Processes: In the processes ring, we find those elements of a system that convert energy from one form to another. At a nation system level, we would find electricity, petroleum, communications,[16] finance, transportation, agriculture, etc. In a military division, we would find communications, logistics, and transportation. In an Al Qaida, we would find communications, finance, training, recruiting, transportation, etc. The processes ring offers great leverage for system change because a change in this ring will affect the rest of the system.

Ring 3, Infrastructure: In the infrastructure ring, we find those elements of a system that are relatively stationary and constant. At a national level, they include roads, bridges, rivers, ports, and airfields.

Ring 4, Population: In the population ring, we find the demographic groups that categorize the people who are part of a system. Demographic groups tend to respond to similar stimuli (publications, messages, rewards). In the population ring, you address groups, not individuals. For example, if we were trying to foment a revolt by the enemy military, we would send messages that might motivate officers in general to change side.

Ring 5, Agents (Fielded Forces): In this ring, we find those elements in a system that do tactical jobs.

- Agents have latitude in how to do a job, but not whether to do it.
- Agents execute policy but do not have the authority to create it.
- Agents are the instruments of the system.

Examples include: a fighter squadron, an army corps, a flotilla, or in the business world, a sales force or a manufacturing division. Fielded forces are important, but are appendages of the state, are resistant to attack, can normally be reconstituted quickly by an intact state system, and are means to an end, not ends in themselves in either the attack or the defense. They are not the starting point for war thinking!

We must think about the enemy as a system, not an isolated part of it like its military, and that you get the greatest return on your energy investment towards the center of the system.

To conclude this brief overview to the Five Rings Model and its component parts, it is important to reiterate that we must think about the enemy as a system, not an isolated part of it like its military, and that you get the greatest return on your energy investment towards the center of the system, as illustrated below. This does not mean that you can just focus on the center ring and merely decapitate the leader – a strange idea that some people have derived from the system concept. There are some rare instances where decapitation might work, but one of the major concepts of system warfare is to avoid creating single-point failure mechanisms. In other words, if you try decapitation and you fail, you now have to try something else against a system that is prepared and probably countering your efforts. At the same time, you have moved farther into the very dangerous serial world, which we will discuss momentarily. Again, the idea is to affect as many centers of gravity as possible in the shortest possible period of time in order to force the system to change in the way you want it to change. From the impact diagram below and from this discussion, then, it should be clear why even successful attacks on enemy military forces are unlikely to produce the system change you need to accomplish your objectives.

Once the five ring pattern of systems is understood, it is easy to find centers of gravity for any system. You review your future picture for yourself and your opponent and the desired system effects for both. You then start with leadership ring where you identify elements in this ring that will have a disproportionate impact and which will advance the realization of

[14] The second ring has experienced several name changes since my first draft of the concept before the first Gulf War. I originally called it "key production" but came to realize that people were translating the idea as "manufacturing" which was not at all the idea. I then called it organic essentials to capture the idea that there were processes necessary for a system to function properly. That name did not work because some people thought that "organic" meant agriculture. I have most recently adopted the simple name "processes" and have found this word to work satisfactorily for both military and the business situation. When you think about processes, think about conversion mechanisms such as electrical generation, communications, recruiting, etc.

[15] In the original version of the Five Rings, I called the fifth ring "fielded forces" because I was only concerned at the time with geopolitical structures and the name worked well. As I subsequently took the Five Rings into the business world, I found that "fielded forces" was confusing so I changed the name to "agents." "Agents" is a broader word and is somewhat preferable to "fielded forces," but users who are only interested in the military application of the Five Rings can certainly use the older, somewhat more limited term.

[16] At the time of the first Gulf War, we included communications in the first ring. After a lot of thought and experience in using the model in many other places, however, it became clear that communications was not just the province of the leader, but one that affected everyone in the system all the time. Thus the decision to put it in the second ring.

your future pictures. After the leadership ring, you do the same thing for the remaining four rings.

A note of caution for using the Five Ring Model and centers of gravity: Do not confuse vulnerabilities and centers of gravity. Vulnerability is only of interest when you start making plans to affect a center of gravity. A center of gravity exists because of its important relation to the system. If you allow yourself to look for vulnerabilities at a strategic (or operational) level, you are very unlikely to find the real centers of gravity in the system. The rule is: find the centers of gravity. You will find that once identified, there is invariably a way to affect them.

> An attack against industry or infrastructure is not primarily conducted because of the effect it might or might not have on fielded forces ...

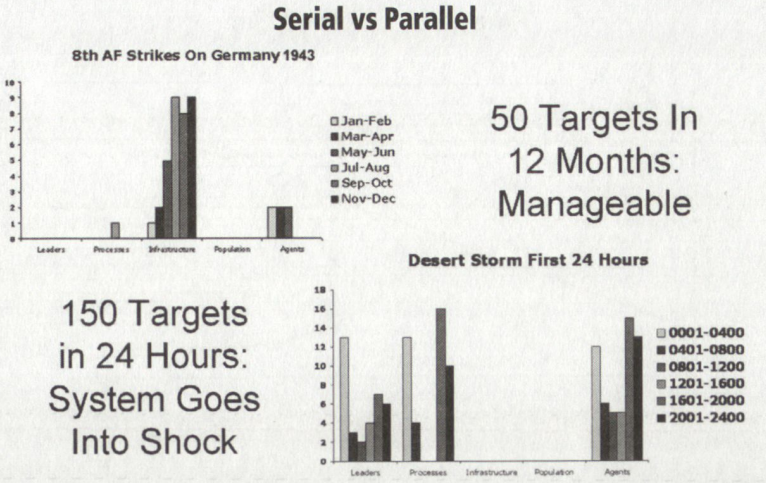
It is imperative to remember that all actions are aimed against the enemy system as a whole. Thus, an attack against industry or infrastructure is not primarily conducted because of the effect it might or might not have on fielded forces. Rather, it is undertaken for its direct effect on the enemy system.[17]

Parallel versus Serial Attack

The way we go after the Centers of Gravity is very important. We can do things serially or we can do them in parallel. If we do things serially, it means we do one thing at a time. We concentrate our resources to solve problem number one. Then we move on to the next problem, and so on.

The alternative to serial operations is parallel operations where you focus your resources on changing an entire system at one time, whether that system is a market, an organization, or an opponent like Iraq. This concept of parallel operations is not widely understood or used. It was designed to make things happen very, very quickly at minimum cost and risk, and to create changes that would last.

Serial operations give an opponent ample opportunity to react. Each time the opponent reacts; the attacker is faced with an entirely new set of problems. Serial operations are to be avoided whenever possible – and to some extent, it is always possible to avoid them. Do not give the system standing between you and your future pictures the opportunity to do what it wants to do, to repair itself, to figure out how to thwart your next move.



Parallel operations are faster, safer, cheaper, and more likely to succeed than serial operations. The graphic above presents a stark example of the difference in the two approaches. The top half tells the story of American daylight bombing of Nazi Germany in 1943, the year U.S. operations began. The bottom half tells the story of the first 24 hours of the Gulf War.

The United States Air Force began daylight bombing attacks on Germany itself in January of 1943. In all of 1943, the responsible command, Eighth Air Force, was only able to hit approximately 50 targets and did so at a rate of about one target complex per week. In response, the Germans simply assembled all of their resources to fix each bombed target. Being smart people, while they were repairing damage, they worked on ways to make themselves less vulnerable – like dispersing some of their industry. They rapidly learned how to shoot down more American bombers. The system under attack by the American forces was actually getting smarter as the attacks progressed. Obviously, the American side was getting smarter too, but nothing changes very much in this kind of a scenario. What we saw in the 1943 skies over Germany was a replay of a million serial operations that had preceded it. Now, let us examine the parallel war case.

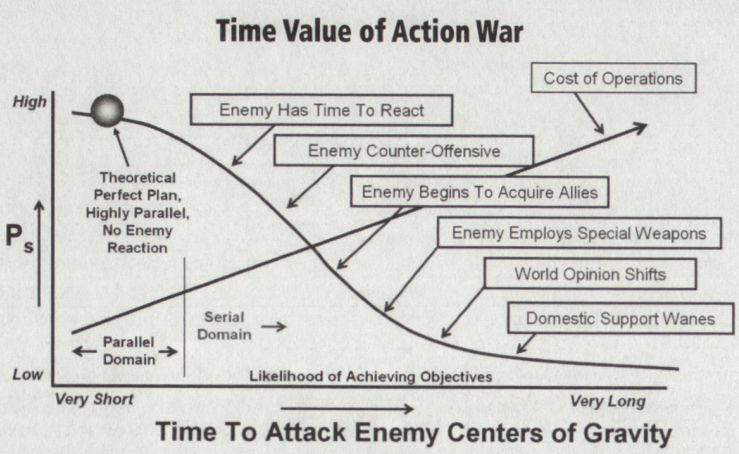
> One hundred and fifty targets in 24 hours means that rate of target attack was 1000 times faster than were the 1943 attacks against Germany.

At 3:00 AM on the 17th of January 1991 (Baghdad time), Iraq came under an attack that was unprecedented in concept, in technology, and in scope. Within the next 24 hours, the Allies (primarily the United States) struck about 150 targets that represented critical centers of gravity in the Iraqi system. One hundred and fifty targets in 24 hours means that rate of target attack was 1000 times faster than were the 1943 attacks against Germany. The German system under serial attack had learned and had managed to keep itself functional; the Iraqi system under parallel simply went into shock, it could not deal with what was happening to it, because so many things were "broken" in parallel.

Parallel Attack In Iraq

Instead of trying to deal with Iraq serially as we would have in the past, we brought the whole Iraqi system under parallel attack by hitting a number of strategic centers of gravity almost simultaneously. The results were spectacularly different from the serial case. In a very short period of time, important facilities and functions all around the country were no longer operable. Communications between government and military officials was difficult to impossible; electricity was no longer generally available to do all of the seemingly mundane (but really critical) things it does; and senior military officials themselves were not available to make crucial decisions. The totality of what happened to Iraq as a result of parallel operations was incipient strategic paralysis. In other words, Iraq was unable to repair itself, unable to learn, and unable to respond in any meaningful way. Of almost equal importance is this: we actually missed some important targets. Unlike missing in the serial case, however, missing when you are conducting parallel operations against a system does not make

[17] Attacks on the system may have a big impact on the enemy leadership. If the leadership is rational, it is likely to sue for peace long before their system is paralyzed or destroyed. The leadership will generally assess the cost of rebuilding, the effect on the state's economic position in the postwar period, the internal political effect on their own survival, and whether the cost is worth the potential gain from continuing the war. It is an excellent outcome for you when the enemy leadership makes the right decision prior to you completing your operations. But again, you should do your best to avoid dependence on a rational decision. (See earlier discussion about psychological operations)



too much difference, because hitting one target does not depend on another target being previously hit. The difference between serial and parallel operations is stark: the former is risky, chancy and takes a long time; the latter is low-risk, predictable, and takes a short time. Given a choice, and there is almost always a choice, anyone who would do serial operations rather than parallel is not serious about winning.

People think that there will be an increase in information, energy, and resource needs for parallel operations. Paradoxically, exactly the opposite is the case.

Parallel operations, whether in business or elsewhere, have substantial advantages over serial operations. They are faster, cheaper, and more likely to achieve success. They do, however, require a different mindset – and an organizational structure that may be much more dynamic than that of most organizations. Start thinking parallel!

Frequently people think that there will be an increase in information, energy, and resource needs for parallel operations. Paradoxically, exactly the opposite is the case. For example, when you are doing things serially, you really must have the right information about each target. If you attack the wrong place at the wrong time, and you are only doing one thing at a time, it simply stops you. You must get it right before you can go on – that is the whole concept of serial operations. In contrast, for parallel operations, the importance of perfect knowledge or perfect execution against any given target is less. That is true because your goal is to have systemic effect versus the single-point effect that is mandatory in the serial world.

Conclusion

System warfare provides the most positive resolution of conflicts. To execute it well, however, we must reverse our normal method of thinking; we must think from the big to the small, from the top down. We must think in terms of systems; we and our enemies are systems and subsystems with mutual dependencies. Our objective will almost always involve doing something to reduce the effectiveness of the overall system. At the same time, we must take necessary action to ensure that the enemy does not do unacceptable damage to our system or any of its subsystems.

We must not start our thinking on war with the tools of war – with the airplanes, tanks, ships, and those who crew them on both sides. These tools are important and have their place, but they cannot be our starting point, nor can we allow ourselves to see them as the essence of war. Fighting is not the essence of war, nor even a desirable part of it. The real essence is doing what is necessary to make the enemy accept our objectives as his objectives which means affecting his system, before he can affect ours. This means parallel war against centers of gravity.

The True Worth of Air Power

Robert A. Pape

The Wrong Revolution

For more than a decade, advocates of precision air weapons have argued that wars can be won by selectively taking out an enemy's leaders, its communication systems, and the economic infrastructure of its major cities. Before the Persian Gulf War, Air Force Chief of Staff General Michael Dugan promised to end the war in days by targeting Saddam Hussein directly. Later, in Kosovo, General Michael Short, commander of allied air forces in Europe, ordered air power to "go for the head of the snake." And last year, in the Iraq war, Secretary of Defense Donald Rumsfeld sponsored a "shock and awe" air campaign against the Iraqi leadership. Whether it helps kill enemy leaders, isolate them from their troops, or make them vulnerable to overthrow by local groups, precision air power is advertised as a force that can win wars on its own.

Decapitating the enemy has a seductive logic. It exploits the United States' advantage in precision air power; it promises to win wars in just days, with few casualties among friendly forces and enemy civilians; and it delays committing large numbers of ground troops until they can be welcomed as liberators rather than as conquerors. But decapitation strategies have never been effective, and the advent of precision air weaponry has not made them any more so.

No doubt, precision technology has increased the accuracy of bombing. Today, 70 to 80 percent of guided munitions fall within 10 meters of their targets, even at night, with overcast skies, or in moderate winds. This is a remarkable improvement compared to World War II, when only about 18 percent of U.S. bombs fell within 1000 feet of their targets, and only 20 percent of British bombs dropped at night fell within 5 miles of theirs.

Yet greater accuracy has not enabled air operations alone to win major wars any more than they did before the precision age. Independent air operations have rarely been decisive. From World War I until the 1980s, they were most effective in support of ground power, serving as the "hammer" to ground power's "anvil," with the anvil usually doing most of the work. Thanks to precision weapons, air power has become a far more effective complement to ground power; the hammer now does much more work for the anvil.

Precision air weapons have fundamentally changed military power, but they have not brought about the revolution often proclaimed by many air power advocates. Despite precision bombing, enemy decapitation has not become "the new American way of war." Rather, precision weaponry has revolutionized contemporary warfare by multiplying the effectiveness of using air and ground power together. The United States, in other words, still wins its wars the old-fashioned way. But with new precision air weapons, it now does so better than ever.

Off with Their Heads?

The strategy of enemy decapitation has inherent shortcomings, which precision technology, for all its advantages, cannot overcome. U. S. forces have tried the strategy on six occasions in the past 16 years, and it either failed or backfired each time.

The tactic proved largely ineffective in Afghanistan in 2001, when the United States dedicated weeks of air strikes to trying to kill Mullah Muhammad Omar and

other Taliban leaders. Prior to last year's war, it had also achieved little in Iraq. The United States attacked 235 strategic targets in and near Baghdad in the opening days of the 1991 Gulf War and subsequently about 100 leadership and other targets in the four-day Operation Desert Fox in 1998. Both campaigns failed to kill Saddam or to weaken his control over his troops and the country.

Last year's shock-and-awe campaign in Iraq also yielded disappointing results. Raids against hundreds of targets during the war's early stages failed to kill or topple Saddam. Admittedly, they did help raise confidence in the imminent collapse of his regime and paved the way for the arrival of ground troops, who eventually caught Saddam last December. But late last March, General Richard Myers, the chairman of the Joint Chiefs of Staff, acknowledged that the Pentagon's strategy to knock out Saddam's regime early on using devastating air assaults had proved less effective than expected.

In other instances, decapitation tactics have proved downright counterproductive. The 1986 bombing of Muammar al-Qaddafi's tent by the U.S. Air Force, which missed him but killed his young daughter, probably precipitated the revenge bombing of Pan Am flight 103 that killed 270 civilians. In March 1999, in an attempt to strong-arm Serbian President Slobodan Milosevic into adopting a more forthcoming policy toward ethnic Albanians in Kosovo, the United States launched what was supposed to be a three-day air campaign against 51 targets in and near Belgrade. Not only did these strikes fail to coerce Milosevic, they prompted the Serbian military to kill thousands of Kosovars and expel almost a million from the country.

The development of increasingly precise weaponry has not made decapitation strategies any more viable.

The development of increasingly precise weaponry has not made decapitation strategies any more viable, for three reasons. First, killing leaders and accurately attacking communications networks depends more on military intelligence than on precision in combat. Without precise intelligence, precise weapons may precisely destroy targets that are not in use. Second, there are generally so few leadership targets that they can be destroyed even without precision weapons. Third, even successful hits may not translate into coercive success. Determining which ones will is a problem of political forecasting – and an uncommonly difficult one. No current theory can predict whether air power alone can force regimes to change or assure that they will change in the right direction.

Decapitation has failed repeatedly, in other words, and against a variety of enemies, even when U.S. forces benefited from substantial intelligence and extraordinarily sophisticated equipment. Although precision weapons may produce lucky strikes in the future, there is good reason to doubt that decapitation will become a model strategy for the United States any time soon.

Hammer and Anvil

The United States has chalked up a tremendous military record in the precision age. In just over a decade, it has won five major wars – in Kuwait and Iraq in 1991, in Bosnia in 1995, in Kosovo in 1999, in Afghanistan in 2001, and in Iraq again in 2003 – at the cost of only about 400 combat fatalities overall. Precision air power played an important role in these victories, not by helping decapitate the enemy, but mainly by helping friendly ground power crush enemy ground forces more efficiently.

Precision air weapons have fundamentally changed military power, but they have not brought about the revolution often proclaimed by many air power advocates.

Long before the age of precision weapons, the U.S. Air Force used mass air strikes to destroy critical political and economic targets. U.S. bombers flattened factories and other buildings in Germany and Japan and electric-power plants in North Korea and Vietnam with large numbers of "dumb" bombs. Today's precision weapons have not increased the coercive effectiveness of these tactics, which has always been limited, but they have made it possible to destroy similar targets with fewer sorties.

More important, improved bombing accuracy means that the hammer-and-anvil strategy is far more potent today than ever before. Attacking the enemy simultaneously by air and on the ground puts the enemy army in a quandary. If the enemy concentrates its ground forces in large numbers to form thick and overlapping fields of fire, they become vulnerable to air raids. But if it disperses them to avoid air strikes, opposing ground forces can defeat them in detail, mopping them up with few losses.

In the past, the U.S. Air Force would attack enemy ground formations if they presented especially attractive targets, such as road-bound columns of hundreds of vehicles that could be repeatedly strafed from above. Such attacks played a large role in defeating the Germans on the western front in World War II. Today's precision weapons allow air power to destroy massed enemy ground troops more easily, under a variety of conditions, and to attack other smaller, but still important, battlefield targets. Until recently, air power could rarely destroy tanks, trucks, command posts, or bridges used to supply fielded forces; even thousands of bombs aimed at just a handful of these tiny military targets could miss the mark. Now, satellites, advanced reconnaissance aircraft, and other sensors can reliably locate concentrated enemy forces for precision strikes to destroy. Even if enemy ground forces do not move, precision air power can respond quickly to their defensive fire. Today's precision weaponry thus allows air power and ground forces together to defeat enemy ground forces relatively rapidly and with few losses.

Combined power works best when it exploits the tactics commonly used by large mechanized armies in modern warfare, which have not changed with the advent of precision weaponry. Since World War II, attackers in mechanized warfare have usually tried to break through the enemy line and then advance, through the breach, deep into enemy territory. To prevent such breakthroughs, defenders typically seek to build formidable front lines, so that any section that is attacked can hold out until local reserves arrive. If breakthroughs do occur, defenders use mobile reserves to counterattack the exposed flanks of the penetrating spearheads, in order to cut them off (or at least slow them down) while a new defensive line is established.

Air power plays an important role in this situation. It is a significant offensive tool that can thwart defensive strategies in two ways. Air power can help an attacker weaken the enemy's front line by attacking it directly or blocking its access to supplies and possible reinforcements. More important, air power can also assist penetrating spearheads after a breakthrough, by stopping the movement of enemy reserves deeper behind the front and preventing them from redeploying or concentrating against the attackers.

Combining air and ground power continues to be a winning strategy in the precision age. It has played a key role in the United States' spectacular recent victories: its application helped win four wars, and the prospect that it might be used probably was decisive in a fifth.

Iraq, Part 1

Before the air war began on January 17, 1991, Saddam was highly confident that his army could hold Kuwait. His calculation was simple: the United States, he told April Glaspie, then the U.S. ambassador to Iraq, would not tolerate 10000 deaths. U.S. leaders also believed that if the toll reached those figures, public support for the war would dwindle, and most analysts estimated that it would take at least that many casualties – and perhaps even twice that number – for U.S. troops to win a ground war.

But Saddam was underestimating a critical U.S. asset: overwhelming air superiority; which eventually helped drive his troops out of Kuwait with only 147 U.S. fatalities – fewer than even the most optimistic prewar estimate. The air power that defeated Iraq was not the bombing of Baghdad that captivated millions of CNN viewers, but the direct pounding of the Iraqi army in Kuwait, which denied Saddam a chance to inflict heavy costs on the coalition ground offensive.

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U.S. air power made it impossible for the Iraqis to stop a break-through at the front. Direct raids killed 30000 to 36000 Iraqi troops and convinced another 100000, who had been carpet-bombed and were starving, to desert. Those losses created huge holes in the Iraqi ranks and encouraged most of the remaining front-line infantry to surrender without resistance when the ground war began. Penetrating coalition spearheads found breaches in the Iraqi front up to two kilometers wide, which allowed them to advance along four-lane highways deep into the Iraqi rear without encountering significant resistance.

Air power also destroyed a significant number of Iraq's heavy military equipment - tanks, armored personnel carriers, and artillery – well ahead of the ground offensive. Studies conducted by the CIA, the Marine Corps, and the Army after the war showed that air power destroyed about 20 percent of Iraq's heavy military equipment and caused more to be abandoned by Iraqi troops once they realized the equipment was being targeted. Overall, some 9500 precision-guided munitions destroyed about 2500 pieces of Iraq's heavy military equipment. This is not a perfect score, but new-generation weapons were considerably more effective than "dumb" bombs would have been against similar targets.

Finally, air power prevented Iraq's mobile reserve forces from concentrating or otherwise moving in significant numbers inside the theater, which kept them from filling gaps in the front lines or blocking coalition ground forces that penetrated their lines. The Iraqi troops' mobility was significantly hindered as soon as the coalition gained air superiority; that was demonstrated as early as during the al Khafji battle in late January. In that confrontation, air raids defeated initial battalion-sized assaults by the Iraqis and then attacked without mercy two Iraqi heavy divisions that were detected marshaling for a follow-up attack. During the four-day ground campaign in February, coalition ground forces advanced almost twice as fast as expected, largely because the Iraqi mobile reserves, although still substantial, could not counter-concentrate en masse to oppose the breakthroughs at the front.

Bosnia, 1995

The combination of air power and ground power also had a potent effect during the Bosnian war: it brought the Serbs to the bargaining table and helped determine the boundaries of the final map negotiated at Dayton. Although not a single bomb fell on Belgrade during this conflict nor was even a senior Bosnian Serb leader killed, U.S. air power was used to great effect in the field. Bombs were dropped on battlefield command posts, military units, and supply bridges in Bosnia, while 100000 Croat and Bosnian Muslim ground forces attacked the 50000 troops of the Bosnian Serb army. For the first time, the hammer-and-anvil strategy used U.S. precision air power working alongside local ground forces.

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The use of strong coercive pressure began in the summer of 1995, shortly after Bosnian Serbs executed thousands of Bosnian Muslim civilians at Srebrenica. On August 4, some 100000 Croat troops launched an intense assault on Krajina, a region of Croatia then under Serb military control. They quickly overran the area, causing most of the region's 175000 Serbs to flee into Serb-held territory in western Bosnia. On September 8, Croat and Bosnian Muslim troops began a combined ground offensive toward the city of Banja Luka, where 350000 Serbs lived. Within a week, they were just 20 miles from the city, having seized about a third of the Serb territory in Bosnia. The Bosnian Serbs' political leader, Radovan Karadzic, then promptly agreed to comprehensive talks and withdrew heavy weapons from Sarajevo. ("If we have a cessation of hostilities agreement," he said, "it means there is not going to be war in Sarajevo any longer.") The cease-fire went into effect on October 12.

The U.S. air operation Deliberate Force was a critical complement to forces on the ground, largely because it bombed military targets in Bosnia and hindered the Bosnian Serb army's ability to counter-concentrate against the oncoming Muslim-Croat ground offensive. From August 30 to September 14, U.S. air strikes delivered 1026 bombs against 56 military targets in western Bosnia and near Sarajevo – less than half the munitions used per day against Saddam's army in the Persian Gulf War, but enough to debilitate the far smaller and less heavily armed Bosnian Serb army.

Americans naturally call attention to the role U.S. air power played in coercing Milosevic to surrender, but it accomplished this result only by helping shift the balance in the ground war. The Dayton boundaries are, almost to the kilometer, the front lines controlled by the Croat and Muslim armies at the moment the peace agreement was signed in the fall of 1995. Top U.S. officials acknowledged that the combined use of air power and ground power helped win the war - and shape the peace. General Michael Ryan, the commander of allied air forces, observed that "it took both" – air power "nailed down" the Bosnian Serbs, preventing them from responding to the Muslim-Croat offensive on the ground. Ambassador Richard Holbrooke, the chief U.S. negotiator at Dayton, recalled, "I told [President Franjo] Tudjman [of Croatia] [that] the [ground] offensive had great value to the negotiations. It would be much easier to retain at the table what had been won on the battlefield than to get the Serbs to give up territory they had controlled for several years."

Back to the Balkans

The 1999 war in Kosovo is a more ambiguous illustration of the effectiveness of combined-power attacks, because it still is not entirely clear what pushed Milosevic to surrender Kosovo to NATO forces on June 3, 1999. Of the three most plausible theories for the war's end, however, the most convincing is that it was NATO's threat to invade Kosovo by using air power

and ground forces simultaneously that turned the tide.

The first – and least likely – explanation for Milosevic's surrender is that he believed that the Kosovo Liberation Army (KLA) might seize Kosovo with the support of NATO tactical air power. Although the KLA did grow stronger during the war and NATO air power destroyed some Serbian heavy equipment during its 78-day campaign in the spring, the KLA remained far too weak to seriously threaten the Serbian army. It had not recorded a single offensive success – not even by the war's end - and it would have been no match for the Serbian army, which still had 47000 soldiers and more than 800 tanks, armored personnel carriers, and pieces of heavy artillery – all in good condition – when it pulled out.

Another theory holds that Milosevic surrendered under the threat that NATO might use strategic air power against Serb civilians. Although this explanation cannot be ruled out categorically without serious evidence of Milosevic's motivations, it too seems unconvincing. In the 90-year history of offensive air power, threats to inflict harm on civilian populations by conventional bombing have never forced an adversary to abandon important goals.

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There is little reason to think that Kosovo would be the first exception to this rule. NATO bombs killed about 500 Serb civilians – a modest toll by historical standards. Strategic air power had damaged Serbian infrastructure, including oil-refining capability, major bridges, and, temporarily, the electric-power grid. But by the time Milosevic surrendered, the rate of attacks against new strategic targets was sharply declining, especially in the weeks after NATO had embarrassed itself by bombing the Chinese embassy in Belgrade. Moreover, it is unlikely that NATO would have deliberately chosen to inflict much more harm on civilians, given that public opinion in the West would not permit the direct targeting of residential areas or food stocks.

Even if NATO had set out to do so, there is good evidence that severe economic losses to the Serbian people would have had little influence on Milosevic's behavior. Serbian society had already absorbed significant economic pain. Sanctions had cut Serbia's GNP by half between 1989 and 1998. And for five years before the bombing, more than 25 percent of Serbia's population had been chronically unemployed. Nor was there any sign that Serbia was on the verge of a civilian uprising. By all accounts, the Serbs were becoming apathetic as the bombing continued. If anything, it was Milosevic's surrender that prompted street protests in the summer of 1999, and many of the demonstrators wanted him replaced because he had lost Kosovo, not because the Serbian economy had been damaged.

The more likely explanation, then, is that Milosevic surrendered from fear that NATO would invade Kosovo, with the devastating help of precision air power. In early June 1999, the United States, the United Kingdom, and other NATO countries were about to formalize a decision to mount a ground invasion of Kosovo. Former Russian Prime Minister Viktor Chernomyrdin undoubtedly communicated to Milosevic, with whom he met numerous times that spring, that a ground war was coming. (On June 8, Chernomyrdin said in a press conference in Moscow, "If the current peace plan for a settlement in Kosovo is not carried out, the situation in the region may develop according to a different scenario. NATO has a plan for carrying out a ground operation.") The United States and the United Kingdom also took strong measures to make that threat credible. Coalition forces widened supply roads in Albania and deployed more than 35000 troops on Kosovo's borders, while the United Kingdom called up 30000 ground-force reservists.

Anticipating a ground attack by NATO, Russia and Serbia tried to establish a Russian military presence in northeastern Kosovo in order to partition the region and retain control over some of it. Although the effort failed, it suggests that the Serbs and the Russians considered the threat of a NATO invasion credible and believed that Serbia would be defeated.

Toppling the Taliban

The United States won the 2001 war in Afghanistan by imitating and updating the blueprint it had tested in Bosnia, combining precision air power with ground attacks by local troops. Once again the tactic proved devastating. The Taliban's front lines collapsed within days of first being battered from the air and on the ground, opening the way for the Northern Alliance to quickly overrun Mazar-i-Sharif and Kabul.

Since the Taliban had virtually no air power and meager air defenses, U.S. air supremacy was assured before the first bomb fell. The first month of bombing, October 2001, thus focused on command-and-control facilities and other leadership targets. But after that strategy failed to kill Mullah Omar or other critical enemy leaders, air power was turned against the Taliban's 25000 or so troops in northern Afghanistan, most of which were concentrated in the front lines. In early November, U.S. special operations forces teamed up with U.S. Air Force combat controllers to use U.S. air power to support Northern Alliance assaults on the ground. At that point, the Northern Alliance, with its few tanks and 20000 troops, controlled just ten percent of the country and was losing against the Taliban.

In early November, U.S. special operations forces teamed up with U.S. Air Force combat controllers to use U.S. air power to support Northern Alliance assaults on the ground.

The hammer-and-anvil strategy most clearly showed its worth at Bai Beche, on November 5, during a key opening battle in the fight for Mazar-i-Sharif. Northern Alliance troops charged the enemy's front lines at Bai Beche, while dust and smoke from a recent bombing raid still hung in the air. Remaining Taliban fighters simply abandoned their positions to avoid capture or death. Within a week, Mazar-i-Sharif fell, prompting many warlords across the country to defect to the Northern Alliance. This in turn allowed the insertion of yet more U.S. special operations teams and U.S. Air Force combat controllers. Kabul fell a few days later, with hardly a fight, as did Kandahar, the last major Taliban outpost, on December 9.

As the war in Afghanistan shows, the hammer-and-anvil strategy is no more effective than the decapitation strategy at killing enemy leaders or combating lightly armed and loosely organized insurgencies. But it is far more successful at achieving the objective that wins major military victories today: defeating an enemy's capacity to organize its resistance by concentrating large ground forces.

Unschocked, Unawed

In the Iraq war last year, the United States quickly conquered Baghdad and vast portions of Iraq with few casualties. Although full information about the tactics the United States used there is still unavailable, it appears that the war was won once U.S. air power shifted from attacking

leadership targets to bombing Iraq's Republican Guard and other regular military units. The air raids enabled U.S. ground forces to move relentlessly through many contested choke-points and overrun key strategic positions before major Iraqi combat units could reorganize for a protracted defense of Baghdad.

The war began with an effort to shock and awe the Iraqi leadership into capitulating without a fight, but this quickly failed. As a result, U.S. air power was soon turned against Iraq's forces in the field. Saddam had deployed them along the key approaches to Baghdad, rather than at the country's borders, probably in an effort to inflict significant casualties on U.S. ground forces, or slow them down, on their way to the capital. Tens of thousands of troops – 40000 according to Baghdad, 24000 according to coalition intelligence – from Saddam's most loyal forces, Republican Guard divisions, and other stalwart regular divisions, formed a defensive ring south of Baghdad. For ten days, the Republican Guard and other key divisions withstood intense U.S. bombardment. More than half of the 28000 bombs dropped by U.S. pilots during the war were directed against the Republican Guard, and more than two-thirds of those were precision strikes aimed at heavy armor and other vehicles. Relatively few Iraqi troops seem to have been killed, but strikes on their heavy armor apparently compelled most of them to keep away from the equipment, effectively disabling Iraqi resistance to the approaching U.S. ground forces. According to the Pentagon, all but 19 of the Republican Guard's 850 tanks had been destroyed or abandoned, and only 40 of its 550 artillery pieces were still usable.

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Yet the breaking point in the war appears to have come during the second week, when U.S. ground forces advanced against Iraqi positions that had been and were still being pounded from the air. Caught in a vise between air strikes and ground attacks, most Iraqi troops deserted. As Brigadier General Allen Peck, a key member of the air command center, put it, "Ground troops forced the enemy's hand. If they massed, air power could kill them. If they scattered they would get cut through by the ground forces." Washington's victory in the Iraq war marked another success for the combined-power strategy.

It ain't broke

Over a decade into the precision revolution, the record points to a simple conclusion: the greater accuracy and surveillance capabilities of today's precision equipment enable air power to support ground campaigns far more effectively than in the past. Under some circumstances, air power has even become the military's main force, with ground power operating in a supporting role. Precision weaponry has not, however, eliminated the need for significant ground forces. There has been a precision revolution, but not the one touted by air power's advocates. The real revolution has not turned leadership targeting into a winning strategy; it has multiplied the combined effectiveness of air and ground power against enemy forces on the battlefield.

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This analysis has important implications for the future of the U.S. military. Advocates of the decapitation strategy are calling for a fundamental transformation of the U.S. armed forces. They argue that the United States should rely more heavily on strategic air power and long-range standoff strikes by naval forces. At the same time, they argue for decreasing the role of the U.S. Army and converting its heavy combat divisions into light formations that would swarm around the enemy, rather than confront it head-on. Such a transformation would make sense if the United States could effectively destroy enemy leaders or their ability to command their forces. But decapitation alone is an unreliable strategy, and the U.S. military should not be reformed according to it – or in anyway that undercuts proven tactics, especially when they are more potent than ever.

Integration, not transformation, is the way to make the U.S. military more effective in the future. The precision revolution has already transformed the nature of U.S. military power. The recent proliferation of cheap computers – which brought microelectronics to weaponry – has facilitated most tasks in nearly all areas of air, ground, and naval warfare. These tasks rely heavily on advanced sensors, precision-guided munitions, and computerized information processing. U.S. military forces are now more effectively destructive, at greater range and speed, than ever before. Although diffusion of precision technology throughout the U.S. military will surely continue, it has already transformed the way each of the military's branches operates.

What the U.S. military must do next is integrate the reconnaissance, maneuver, and tactical-targeting systems that currently operate separately in its individual services. The increasing lethality of high-accuracy weapons makes the combination of firepower and movement much more powerful when air and surface forces work together. If the first two decades of the precision revolution were about bringing microelectronics to weaponry, the next should be about integrating the separate systems in the military's various branches that run on this sophisticated equipment.

The main contribution that the U.S. Air Force can make would be to increase its capacity to carry large numbers of bombs to operational theaters, rather than its ability to deliver fewer munitions through stealthy means of penetration. For decades to come, there will be a greater need for relatively cheap tactical strike aircraft, such as fast-disappearing aircraft from the Cold War (A-10s, F-111s, and B-52s), than for billion-dollar strategic bombers that can fly 10000 miles at a time but can conduct only a handful of sorties every few days. A few F-22s (or electronically upgraded F-15s) are necessary to secure the superiority of the U.S. Air Force, but what the force needs above all is a new generation of "bomb trucks."

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The leading advocates of the precision revolution have it exactly backwards. Precision weaponry has done little to enhance the coercive strength of enemy decapitation or other new strategies, which often fail because of inadequate intelligence. After a decade and a half of trying – and failing – to solve this intelligence problem, it may be time to recognize that it will not be overcome any time soon. Until it is, the combined use of air power and ground forces – whose potency has been multiplied by precision weapons – remains the most effective way for the United States to win major wars. ●