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LINKING TARGET SELECTION TO POLITICAL OBJECTIVES

by

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Preface

This paper attempts to combine two diverse concepts. Can a systems analysis tool developed to improve industrial productivity be used in a military scenario to help strategist link political objectives to target selection? What led me to seek the answer to this question was a fortuitous enrollment in an Air Force joint doctrine course at the same time I was taking a course in Dr. Goldratt's Theory of Constraints at Embry-Riddle University. I saw many similarities between Dr. Goldratt's thoughts on weak links in systems and the joint doctrine course's goal of finding the critical vulnerabilities in an enemy's centers of gravity. It certainly seemed possible that if Dr. Goldratt's tools could find the constraint in a large industrial system, they could find the weaknesses in an enemy system.

I want to thank Major Ruby for asking the hard questions, the kind of questions that force you to look at your work as a reader would. I also want to thank Dr. Mel Anderson at Embry-Riddle University in Colorado Springs, CO. He made me a Theory of Constraint believer. I have used the tools in every aspect of my life and I think my life and me are better because of it.

Abstract

Since airpower strategists began seeing the enemy as a single system made up of groups of components, our targeting philosophy has evolved from trying to effectively blow things up to blowing things up for effect. Our goal is to find and effect the targets that will ultimately lead to attainment of our political objectives. Yet, how do we logically link a target to the desired political objectives? If we consider the enemy as a system, we realize that an action on one part of the system will often result in unexpected reactions in other parts of the system. We must take a systems approach to targeting. However, the experts on systems theory are not in the military but in the business world. One such expert is Dr. Eliyahu Goldratt. He has developed a logical method for exposing links in complex business systems, called the Theory of Constraints. Military planners can use these same tools to uncover links within and between an enemy's centers of gravity.

Chapter 1

The Enemy as a System

Therefore when using troops, one must take advantage of the situation exactly as if he were setting a ball in motion on a steep slope. The force applied is minute but the results are enormous.

—Sun Tzu

Since the first fragile airplane flew into battle, aircraft commanders have viewed the enemy differently than surface commanders. The pilot would climb into the cockpit and fly over the troops fighting in the trenches below to attack targets far beyond the melee of the front lines. This ability to fly to the heart of the enemy gave rise to a thought not expressed since Sun Tzu wrote of those skilled in war who could subdue the enemy's army without battle[1]. Perhaps with airpower, defeating an enemy's army was not necessary to defeating the enemy state. Destroying a nation's will to fight shifted from a linear process that began on the battlefield to a parallel process that began with the initiation of hostilities. Suddenly, attacking cities, industry and infrastructure could theoretically allow you to win a war without engaging the enemy's armed forces. But substantiating such a theory proved difficult in practice.

Even during World War II where strategic bombing came of age, military leaders questioned the actual contribution of the air campaign. Giulio Douhet's grand post-World War I prediction that air power alone could destroy an enemy's will to fight seemed to fall short over the skies of London, while simultaneously being vindicated in the skies over Tokyo, Hiroshima and Nagasaki. American airpower strategists gleaned a different lesson from the experiences of

World War II. They were convinced that victory lie in attacking things rather than people. Why expend resources destroying a tank in battle if you can destroy the tank factory itself, preventing any further tanks from rolling off the assembly line? Victory seemed to be a matter of bringing pain to a nation by destroying the infrastructure that made life worth living and war provocation possible. American airpower strategists saw within the nation, a huge industrial web that if attacked would send the whole national industrial complex crashing down like a house of cards.[2] But if an entire nation lay before the might of airpower, how do you decide what targets to strike?

Airpower strategist Colonel John Warden's five-ring model seemed to answer that question by bringing more structure and a hierarchical layering to the industrial web concept. Warden's model likened the enemy state to the human body, with the body's skeleton, cells, self-protection mechanism and brain analogous to the infrastructure, people, military and leadership that make up a normal society.[3] If you incapacitate the vital "organ" of the enemy, the leadership, then the enemy war machine would cease to function, much like a well-conditioned prizefighter being leveled by a single blow to the head. But Warden's thoughts are not revolutionary, they are evolutionary. His is just another branch in the logical thinking process that originates with the certainty that airpower is, by its very nature, a strategic weapon. Rather than being limited to targets directly affecting the front line battle or the infrastructure that directly manufactures war materials, Warden asks us to view the entire nation as a potential target. No longer just an industrial web, the enemy is seen as a national web composed of a plethora of people, thoughts, capabilities and infrastructures that support the nation's will to fight. Perhaps we have come full circle. We find ourselves once again at the feet of Douhet, who wrote of future wars: "There will be no place where life and work can go on in comparative safety and tranquillity; the

countinghouse will be just as exposed as the trench--perhaps more; imminent danger will hang over everyone and everything."[4] But if choose to no longer judge our military success on the destruction of the enemy's military forces or its war material manufacturing, how do we measure the success of our efforts? How do we determine if our military actions are leading us to political victory?

Notes

[1] Sun Tzu, *The Art of War*, translated by Samuel B. Griffith (New York: Oxford University Press, 1971), 79.

[2] Col Phillip S. Meilinger, "Air Strategy: Targeting for Effect," *Aerospace Power Journal,* vol. 13, no. 4, (Winter 1999): 52.

[3] Maj Howard D. Belote, "Warden and the Air Corps Tactical School," *Aerospace Power Journal*, vol. 13, no. 3, (Fall 1999): 41-42.

[4] Giulio Douhet, *The Command of The Air*, translated by Dino Ferrari (New York: Coward-McCann, Inc., 1942), 179.

Chapter 2

Measuring Military Effects

The political object is the goal, war is the means of reaching it, and means can never be considered in isolation from their purpose.

—Carl Von Clausewitz

What we anticipate seldom occurs. What we least expected usually happens.

—Benjamin Disraeli

Immediately following World War II there seemed to be no doubt about the effectiveness of strategic bombing. Germany's cities and industries lay in ruin. The stark remains of Hiroshima and Nagasaki were gruesome monuments to the power of strategic bombing. But historians began to cast doubt on the true contribution the bombing campaign had on resolving the conflict. Some pointed to the steady increase in German war production in the waning days of the war as evidence of the ineffectiveness of the strategic bombing campaign. And in the Pacific campaign, some began to cast doubt on the effect the atomic bomb had in bringing about the unconditional surrender of Japan. Author Paul Kecskemeti even stated, "We may say in this sense that the Soviet declaration of war played a bigger role in triggering Japan's final move to make a direct offer of surrender than did the atomic bombs."[1] At same time historians were calling into question the past effectiveness of airpower, the US air campaign in North Vietnam was mired in a similar controversy over its seeming impotence. Despite the argument by airpower advocates that the appearance of failure in Vietnam was due to improper airpower application and not a

lack of airpower capability, history nonetheless would remember the Vietnam War as a disappointment for the Air Force. The lesson the Air Force learned from these campaigns was that to be effective in war they would have to become operationally efficient. And efficiency meant precision. The Air Force believed increases in precision would finally quiet the airpower detractors. The emphasis on precision attack combined with the flexibility and range inherent in airpower allowed the Air Force to level precise damage on just about any target it chose. We had become very efficient at causing pain to an enemy to the extent and at the location that we saw fit. However, we had made almost no inroads toward focusing that pain where it would pay political benefits. We had become very effective at the operational art, but had we become anymore effective in using airpower to obtain our strategic objectives?

Many thought the application of Warden's five-ring model in the Gulf War answered this question once and for all. By using a modified version of his plan of parallel attack against the Iraqis, the Air Force brought the entire Iraqi nation to a halt. There is no doubt concerning the effectiveness of the air campaign. However, we must not confuse combat effectiveness with strategic effectiveness.[2] What aspect of the air campaign finally brought the Iraqis to the point where they felt suing for peace was their only option? Perhaps it was the success we had against their strategic air defenses and electric power production capabilities, or our direct attacks on their national-level leadership and telecommunications. Post-war damage estimates, however, seem to refute the theory that the massive air campaign defeated the Iraqi will to fight. They themselves put their civilian death toll at only 2,300 and the major target of Baghdad was described immediately following the war by Greenpeace members as "a city whose homes and offices were almost entirely intact, where electricity was coming back on and water was running."[3] Maybe 10 years of war with neighboring Iran had made the Iraqi people simply tired

of war. Some airpower pundits say the reason for the Iraqi surrender was clear: the XVIII Airborne and VII Corps steady advance toward the Iraqi heartland. So, despite grand success in combat, the Air Force was again left with no direct connection between the destruction of targets and the actual strategic goals we wanted to achieve.

Air Force planners had relied on a new model to determine the Iraqi targets we needed to destroy to negatively effect the enemy's will to fight. For the first time, a campaign model focused mainly on the functional effects we wished to have on targets, not necessarily the amount of destruction we caused those targets.[4] For example, did it matter if our bombs destroyed an Iraqi air defense site if the final result of our attacks was the enemy was forced to abandon the site? Operationally, we concentrated our efforts on the effect our bombing would have on a specific system. Could we destroy a portion of a power plant and still render that plant unusable or was it possible to make leaders ineffectual by destroying their capability to communicate with their military commanders? However, this did nothing to answer the question of how the loss of power or of having incommunicado leadership positively or negatively effected the attainment of our political goals. A case in point comes from a guest speaker at the USAF Air Command and Staff College who advocated destroying more bridges in Kosovo during Operation Allied Force simply because he *felt* causing more damage would effect the enemy's will to fight. This statement demonstrates the difficulty we face in determining the part air power plays in winning wars. Frustratingly, the process of linking targets with political objectives is actually becoming more and more problematic. Wars have become more complex, with political restraints and constraints seemingly at odds with the military campaign we must wage to secure victory. The increased precision of our weapons may complicate the issue even further. How do we determine the political effects of destroying a mere portion of a target if we

are unable to grasp the strategic effects caused by destroying the entire target? Perhaps the answer lies in reexamining the Warden model discussed earlier.

Notes

[1] Paul Kecskemeti, *Strategic Surrender* (New York: Atheneum, 1964) 198-199.

[2] Maj Howard D. Belote, "Warden and the Air Corps Tactical School," *Aerospace Power Journal*, vol. 13, no. 3, (Fall 1999): 44.

[3] Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey Summary Report* (Washington D.C.: U.S. Government Printing Office, 1993), 249.

[4] Ibid., 241.

Chapter 3

Causing System-Wide Effects

It's a simple thing to make things complex, but a complex task to make them simple.

— Meyer's Law

While the Warden five-ring model provides an easy-to-understand view of an enemy system, Dr. Lewis Ware, professor at the Air Command and Staff College, makes the point that models like Warden's falsely represent the enemy as "a disembodied, static unit against which force is exerted but which in itself remains physically passive and unchanging after attack."[1] This highlights the first weakness in the five-ring model. It fails to take into consideration the linkages between the rings, or nodes, in the enemy system. No series of entities, actions or processes can correctly be called a system unless they are linked together in some fashion. Whether that system is the human body, a manufacturing plant or a state society, the nodes must connect for the system to function. Consider how useless a ball bearing plant would be if it received no electricity or raw materials. And no matter how effective the plant manufacturing process is or how efficient the workers are, there will be no ball bearings if transportation is not available to ship the product from the plant. The same applies if no one in authority is available to tell the plant what kind, how many or what quality ball bearings to manufacture. The bottom line is the nodes, or centers of gravity, of a system are vital, but no more so than the connections that allow the nodes to operate as a system.

Dr. Ware also refers to a second weakness of the five-ring analysis, noting that it does not demonstrate empirically in terms of a cause and effect relationship why failure of one ring of the model would cause the failure of the other rings in the model.[2] The five ring model is excellent at dividing entities of a system into logical groupings, but it is not detailed enough to show that all-too-critical cause and effect relationship that is vital to translating political objectives into target selection. The model gives us a starting point in finding targets, not in selecting the proper ones to attack to achieve Liddell-Hart's "better state of peace."

The model's third weakness is its use against enemies that may not meet the criteria of a conventional foe. How do you apply the five-ring model to an enemy that seems to have no clear infrastructure, military or leadership hierarchy?

The final, and greatest, weakness in the five-ring model is its inability as a predictive tool to account for an enemy that changes and learns during a conflict. Models such as Warden's share a limitation in their ability to account for the nonlinear and changing nature of conflict. The core of the problem lies in our obsession with finding "a mathematical equation whose variables can be selectively manipulated to achieve success."[3] What we actually need is tool that will link the objective target to political goals, while being flexible enough to account for a living, breathing enemy. In answering the call for such a tool and to educate planners on the weaknesses inherent in these models, the Air Force has rewritten its doctrine to give planners the guidance they need to try and bridge the gap between operational and strategic goals.

Notes

[1] Dr. Lewis Ware, "Some Observations of the Enemy as a System," *Airpower Journal* vol. 9, no. 9 (Winter 1995): 88.

[2] Ibid., 90.

[3] Maj Howard D. Belote, "Warden and the Air Corps Tactical School," *Aerospace Power Journal*, vol. 13, no. 3, (Fall 1999): 44.

Chapter 4

Evolving Doctrine

It is not necessary to change; survival is not mandatory.

— W. Edwards Deming

Everything should be done as simple as possible, but no simpler.

— Albert Einstein

The latest draft of Joint Publication 2-01.1, Joint Tactics, Techniques, and Procedures for Intelligence Support to Targeting, recognizes the importance of linking targets with strategic objectives: "The purpose of target development is to translate the JFC's objectives and guidance into the production of a joint target list."[1] However, while acknowledging the importance of target selection as a means to meeting objectives, the publication wastes scant space on explaining the complex relationships that exist between different target sets. Despite stating that a target's real importance lies in its relationship to other targets, the publication fails to expound on the thought. It instead concentrates on the key nodes and vulnerabilities of individual systems. We must not ignore how important it is to analyze the entire state system if we want to understand how our actions will effect our long-term goals. The draft of JP 2-01.1 tries to avoid this short-sidedness by warning us of the dangers of choosing targets based simply on past performance.[2]

To stress the point, JP 2-01.1 takes great pains to explain that there is no prepared list of best targets.[3] Yet we always seem to attack the same targets. Is this because after decades of

airpower theory we have honed our targeting skills to the point that we have developed universal targeting templates that work in any situation? Or is it that as nation-states mature, they develop homogenous traits that lead to common weaknesses in all national systems? Perhaps Warden's model and Euro-centric thought causes us to assume that what would cause pain to our society would certainly cause the same degree of pain to an enemy's system? Whatever the reason, we continue to attack bridges, fuel sites, ammunition storage facilities and power grids, fully expecting the destruction of such systems to bring the enemy to its knees. We usually fail to fully analyze the value of each potential target to the enemy, what its destruction will actually mean to the enemy, and how the target's destruction will effect the other important systems in the country. Despite its nebulous treatment of the subject, JP 2-01.1 does acknowledge that the enemy state is made of a system of systems.[4] What is needed is a method of analyzing the connections between those systems to understand how they interact. We can then use that knowledge to exploit them to our advantage.

The connections, or linkages, between critical national system nodes could prove to be very valuable targets. We can achieve exponential results by attacking a single set of targets that, if destroyed or degraded, will negatively affect two or more systems. Equally important, we can better determine the real effects our attacks are having on the enemy. We can use the knowledge of system linkages to bridge the operational and strategic targeting gap. Just because we have the ability to target and destroy, say a bridge in Kosovo, we need to be sure that the destruction of that bridge will cause a desired effect that directly supports national or operational objectives. But how do we ensure that the destruction of that bridge actually will effect the achievement of our objectives?

While it sounds obvious, we should focus our efforts on attacking only the targets that help us achieve our objectives. Otherwise, we not only waste expensive munitions but also put our military members in peril attacking targets that have no strategic value. In short, just because we can attack a target, doesn't mean we should attack that target. So, we return to the question of how the destruction of a target in an enemy system will actually lead to the accomplishment of our political goals. There are two keys to answering that question: understanding the intricacies in a system and understanding the enemy you are facing.

It seems logical to look to industry, the admitted leader in understanding and managing systems, to find a method to examine a complex system like a state. However, history has shown us that applying industrial concepts to military situations is a dangerous practice. We can not judge the success of a military operation the same way we judge the success of an auto plant assembly line. The US's reliance on enemy body count as a measure of success in the Vietnam War proved the futility of using such an inanimate measure on something as animated as war. But, if we acknowledge that the state is a system of systems, we can not completely ignore the vast experience industry thinkers have contributed to understanding systems. One such thinker is Dr. Eliyahu Goldratt and his Theory of Constraints (TOC).

Notes

[1] Joint Pub 2-01.1 Joint Tactics, Techniques, and Procedures for Intelligence Support to Targeting (Draft) January 1999, III-3.
[2] Ibid., III-6.
[3] Ibid., III-6.
[4] Ibid., III-7.

Chapter 5

The Theory of Constraints

Do just once what others say you can't do, and you will never pay attention to their limitations again.

—James R. Cook

Dr. Goldratt's use of the word constraint in his Theory of Constraints should not be confused with the military concept of the word constraint. Military doctrine describes a constraint as something we must do during the prosecution of a war, such as limit civilian and friendly casualties. Dr. Goldratt's concept, on the other hand, uses the word constraint to describe the weak link within every system that prevents the system from obtaining optimum performance. The analogy often used in TOC is to think of a system as a chain. The chain is only as strong as its weakest link. This weak link, or constraint, is where we should focus our efforts to improve the system. Money and effort spent improving other links in our chain will be wasted because unless we find and strengthen the weak link, the chain is no stronger than when we began our improvement efforts. The theory acknowledges that once we strengthen the weak link, our efforts to improve the system are far from complete. Once we find and improve the weak link, the next weakest link in the chain becomes our weakest link, so we must constantly be searching for and strengthening the weakest link. Some economists are not convinced that an entire system can be improved through a continuous series of small improvements to selected areas within the system.

Most system improvement philosophies revolve around improving processes. The goal is to improve the component processes, refining them to their maximum in an effort to improve the entire system. These theories are not concerned with the links between the processes. They prefer instead to concentrate on continuous overall improvements in all aspects of the operation. Quality expert W. Edwards Deming stresses the key to improvement is "repetitive refinement and enhancement of existing processes."[1] He urges organizations to get everyone involved in refining existing processes. Conversely, TOC's approach to improvement is more concentrated on reengineering processes than refining existing processes. So, while TOC has not won over the entire business community, the strengths of its processes and tools may be very useful to military planners.

The key to TOC is its ability to reveal how a constraint in a large system actually effects the final output of the system. TOC does this by building links between the goal of the system and its most critical processes, as well as exposing the hidden links between each of the processes. It is this method of linking weaknesses in a system with the goal of the system that makes this a valuable concept for military use. Goldratt has developed logical tools and models for finding and dissolving the constraints that are inherent in systems. The tools have proved to work in systems as traditional as manufacturing and as diverse as personal relationships. So how can we use TOC to help us link targets with political objectives?

TOC's Military Application

In a military application against an enemy, we will use TOC for the exact opposite reason Dr. Goldratt developed it. While TOC was developed to find and strengthen weaknesses in industrial and business systems, we can use the same concept to find and exploit weaknesses in an enemy state. In military use, we want to find the constraints, or bottlenecks, and exploit them

to detrimentally effect the system. First, we use TOC tools to logically analyze an enemy system and find the processes that are critical to its success. Next, we can use those same tools to expose the critical points that link all the system processes. Lastly, we determine which of these points are vulnerable to attack and use that list of vulnerabilities as a potential target list.

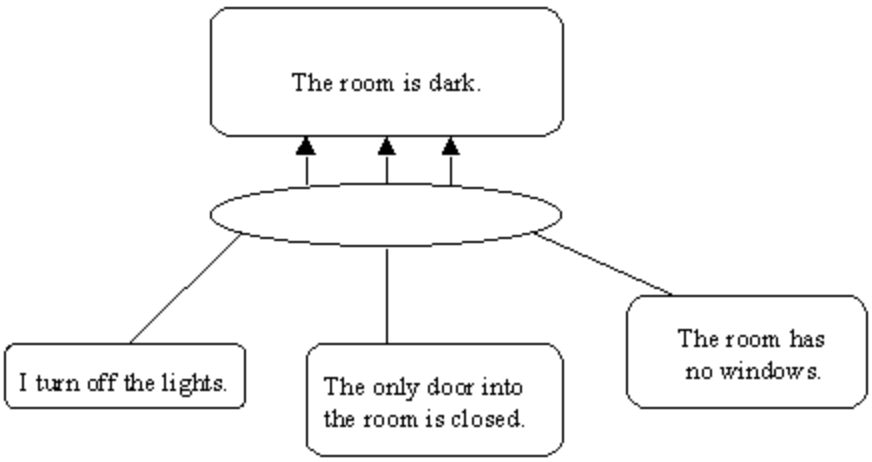
There are two other points in the TOC concept that make it valuable for military use. The first is that TOC recognizes the evolving nature of systems and reinforces the need to adjust to keep your efforts focused on the constraints. The last TOC strength is its focus on the goal or, in business terms, the throughput. It subordinates such business standards as inventory and costs to the bottom line of increasing company throughput, whether that is profits or the delivery of a product or service to a customer.[2] So unlike past industrial models that searched for the one-best way to solve a company's problem, TOC incorporates the dynamic nature of reality into its concept. TOC's successes in solving personal conflicts are ample proof of how this concept is not limited to strictly industrial applications. Despite all its strengths, TOC still suffers from the same weaknesses that plague any analytical model, the bias of the people creating it and the quality of the information we use to populate the model. But recognizing these limitations, TOC can be a powerful tool for the military planner in linking objectives to targets.

This author has taken the five focusing steps of the Theory of Constraints and modified them for a military application. These steps will show us what to change, what to change to, and how to cause change:

1. Identify the system constraint. In this step we will state our goals and use the TOC model to determine the constraint in the system.
2. Decide how to exploit the constraint. In this step we will find the nature of the constraint and work to exploit it through its inherent weaknesses.

3. Subordinate everything else. This step involves making the constraint we found our number one priority and bringing all efforts to bear on changing it. If we are successful at this point, we can move on to the last step. If however the constraint remains, we move to the next step.
4. Elevate the constraint. At this point we acknowledge that our efforts to exploit the constraint are not working and that major changes in our strategy or methods will be needed to exploit the constraint.
5. Go back to the first step. If you have destroyed or degraded the weakness in the system, another weakness will emerge that is key to effecting overall failure of the system.[3]

The first weapon in the TOC arsenal is the Current Reality Tree (CRT). This model will help us find the cause-and-effect logic behind our current situation. The CRT begins with the undesirable effects we see in the particular military situation and assists in mapping a path to a few root causes (constraints) or a single core cause. The simple CRT in figure 1 shows an undesirable effect (the room is dark) and the causes for that condition (the lights are off and there are no windows and there are no doors).[4] The ellipse between the effect and the cause indicates that all the causes are required for the undesirable effect to continue. If only one cause results in the effect, the line would go directly from the cause to the effect.



Sample CRT

Figure 1

Another useful aspect of TOC is that the process for finding constraints includes acknowledging that within the system we are trying to map, there will be areas that fall beyond our span of control or sphere of influence. We may map a system and find constraints that we have no military authority or capability to affect. This is important because in any military operation, we will be faced with restraints that limit the targets we can attack. However, since we will have traced all the links of the system, we will not lose sight of how prohibited constraints that fall outside our span of control link to those constraints we are allowed to attack, and ultimately how they are linked to the goal we want to achieve. In such a case, we might be forced to attack multiple constraints to achieve the same effects as would have been achieved had we attacked the single root cause.

To begin building our CRT, we compose a one-sentence summary of the problem we are dealing with. TOC is basically a cause and effect model, so we state the summary in the form of a question. For example, "Why are the Serbs attacking their neighbors?" Under this question, we begin to list the reasons we believe the statement is true. These are called undesirable effects

(UDEs). UDEs are the most visible indicators of much more complex interactions and processes, so it is important to choose the right UDEs to start the analysis. UDEs are the "gateway" to finding the real cause of the conflict. If we choose the wrong gateway, we won't find the right problem.[5] TOC contains guidelines for choosing UDEs. Each UDE must pass a series of tests, such as agreement by all members of the planning team that the effect is negative, that it does, in fact, adversely affect our goal and that the UDE does actually exist and is not simply our misperception of the events at hand.[6] For example, the UDEs contributing to the question above may include:

a. Historic ethnic problems between factions in the region

b. Bosnian Serbs hegemonic intentions

c. Strength of BSA compared to other regional armies

d. Aggressive stance of Bosnia leader Karadzic

e. Support of sympathetic allies

We will probably be able to come up with many undesirable effects, but try to narrow the list down to the most critical five or so, and list them as shown below. Don't toss out the other UDEs, we can use them later in the model. Remember that we only want to list the UDEs that are the most visible and valid causes of our problem. We will use the CRT process to uncover the actual root causes.

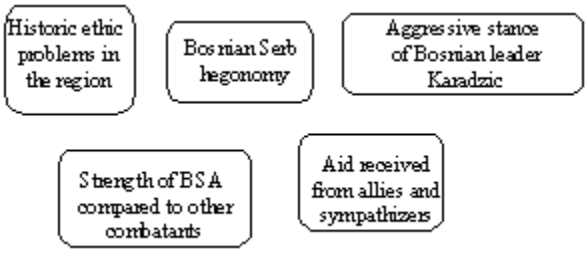


Figure 2

Next, we will begin to build the CRT by combining any of the two UDEs, which may lead to, but not necessarily cause, each other. By asking a series of questions, you can then determine which of the UDEs are actually causes and which are effects. In figure 3, we see that by analyzing the UDEs, we determine that some of them are effects and some are causes. Most effects will have multiple dependent causes. These are represented by the ellipses in our diagram. Sometimes called an "AND" gate, ellipses identify the major contributing causes that are "sufficient in concert but not alone to produce the effect."[7] In the example below, the BSA would not be considered a strong force in the region if it didn't receive aid from allies and it had strong leadership and it was of sufficient size compared to other regional armies. If a cause singularly leads to an effect, we draw an arrow from the cause directly to the effect.

The process continues as you systematically add levels of actual causes by asking "why" of each preceding UDE.[8] In so doing, you end up with a thorough list of causes for the undesirable condition that you want changed. Eventually you create a cause that has no arrows coming into it. This item will be a root cause.

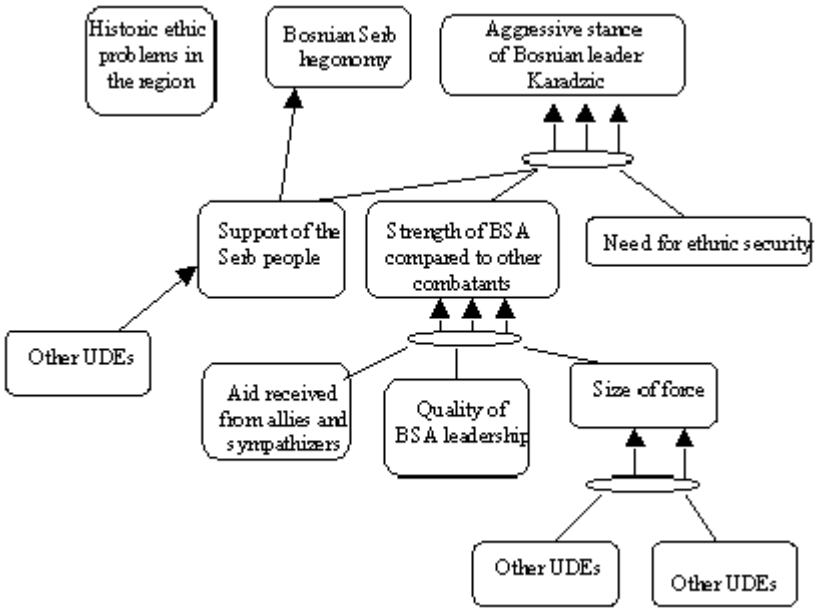


Figure 3

The CRT process continues as you use TOC tools to drill down through causes, systematically connecting all the original UDEs. You eliminate outlining causes and add the original UDEs that were set aside at the start of the process. Some of the causes may fall outside our span of control but still may be within our sphere of influence. Surprisingly, you will find that most of the UDEs will have common causes as you work through the process. A common cause that accounts for at least 70% of the UDEs is considered a root cause.[9] A root cause will also have no arrows entering it, showing that there are no additional reasons for it to exist. Root causes correlate to critical vulnerabilities in the system. It is at the root causes where we need to focus our attention.

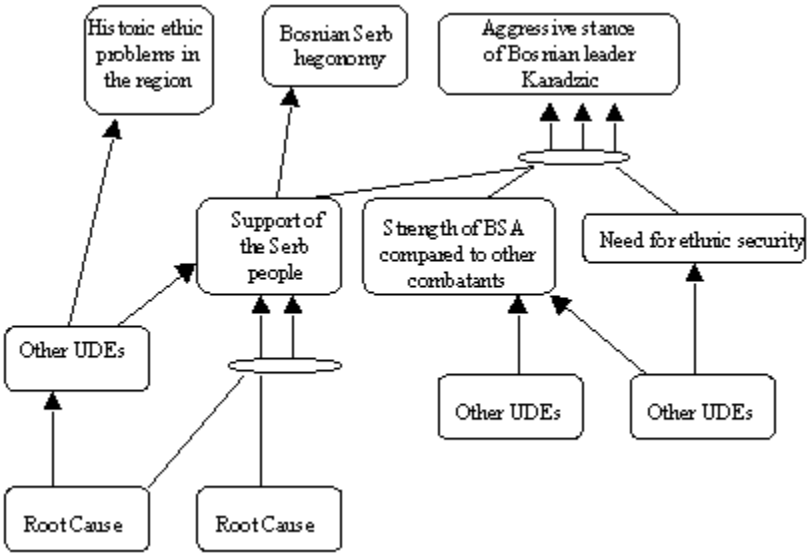


Figure 4

What makes this process so important for military applications is that it uncovers links between all the UDEs, and as the branches continue, root causes become apparent. Root causes that surface are not only the vulnerabilities that we seek when looking to affect enemy systems, but they represent vulnerabilities in multiple systems. Armed with such data, we can target these choke points and cause a hierarchical collapse of multiple systems. Or, knowing that attacking a

target will have broad effects on other systems, we may choose to forgo the attack due to the secondary effects it will have on other systems.

Not only have we developed a logical link between the major causes of the conflict and the targets we need to attack, but also we have uncovered the most vulnerable constraints in the enemy system. TOC may reveal targets not normally identified by experienced planners or it may exclude those targets we are accustomed to striking. Regrettably, this deviation from standard targeting selection will make planners reluctant to trust the system knowledge TOC provides until extensive wargaming or use in actual conflict prove its worth. When we do experiment with TOC in a military application, we must know what to do with the knowledge provided by the CRT.

As many authors have pointed out, just because a potential target is a vulnerability to an enemy does not make it vulnerable to attack. The next step in the process (see figure 5) is to take the model we have built and draw a line around the UDEs and root causes that are within our span of control. This step will enclose the root causes we can effect, thus deciding for us the root causes that are available targets.[10] For various reasons however, targets found to be root causes may not be open to direct military attack. The root cause could be heavily protected or have the potential for undo civilian casualties, making that target unattractive for attack. Another reason root causes may be unavailable for attack is because the cause falls outside the purview of the military instrument of power. In such an instance, we will still be armed with the knowledge that bringing pressure against that cause, whether diplomatic, economic or informational, will affect the system. In the example below, "willingness of allies to help" may not be within the military span of control but it certainly could be within the political sphere of influence.

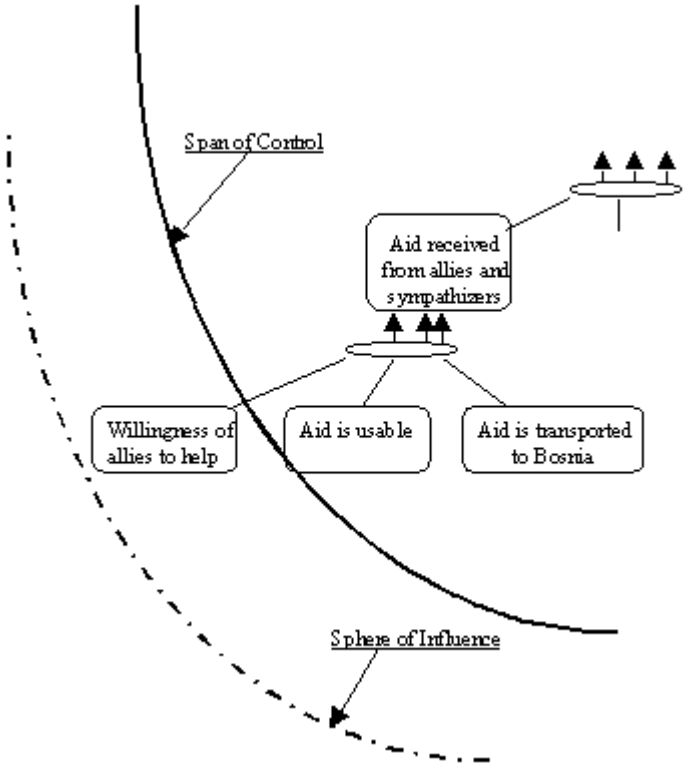


Figure 5

TOC recognizes that the system will continue to change. That is why an integral step in the TOC process is to continuously rerun the same CRT process. If an identified constraint is destroyed or disabled, the system will not completely halt. Other areas in the system will adapt in an effort to keep the system operational. That is why you don't use the CRT as some kind of prioritized target list – starting at the root cause and working up the chain toward the initial UDEs. The best way to use the CRT in a military application is to first find the all the root causes. Next examine the characteristics of the targets to determine those that fall within the military span of control and thus are available to attack. Then determine the vulnerability of the applicable root causes to military attack. If a target is well protected or can not be attacked due to law of armed conflict restrictions, other critical causes around that root cause can be targeted to achieve similar, if not optimum effects. Once vulnerable root causes have been determined, parallel attack can commence against all targets possible. As stated earlier, that current CRT

would become outdated as the enemy system changed to compensate for the initial attacks. A new CRT would uncover new root causes that would need to be attacked. The CRT would evolve as the new enemy system changed.

The TOC process described here is but one of the TOC tools available to find and exploit weaknesses in a system. The tools available in the TOC toolbox include models to help resolve the conflict within the root cause we found in the CRT and a model called a Future Reality Tree that gives a possible view of a system once the constraints have been found and exploited. Also, many private companies offer software that can be used with little training and on any type system. The software asks the user to type in the first set of UDEs and answer a series of questions to build the cause and effect model to the level of detail required.

However, the TOC model is vulnerable to the same two weaknesses that plague any analysis attempt: the bias of the people creating the model and the amount of useful information available about the enemy system. The extensive tools built in to the entire TOC package recognize these limitations and are designed specifically to null these effects. But the problem of in-depth and timely information is a continuing problem and will not go away with the use of TOC.

We must have intimate knowledge of a system in order to build a truly accurate model of any system. Often when we have little information about an adversary, we resort to the assumption that the enemy will act as we would act under similar conditions. The TOC model can be of some value even with the barest of information, while steadily gaining value as the information flow increases. Theory of Constraint tools give us much flexibility in this area. Because the concept works with any system, it can be useful with as little or as much information as we have about an enemy system. If we start a CRT with limited information about a system, we can still find links between all our initial undesirable effects. We may not be able to drill

down as far into the system to find the root causes but we can uncover the correct questions we need answered about the enemy before we can logically link our objects to potential targets. This versatility could prove valuable in asymmetrical conflicts.

In military operations other than war (MOOTW), determining centers of gravity can be difficult. Add to that difficulty more restrictive rules of engagement, the heavy influence of political objectives, and constantly shifting picture of friend and foe, and you can understand why normal models have a difficult time predicting enemy systems in such situations. TOC concepts could have success in a MOOTW situation. Since TOC works for any system, we would begin analyzing the potential conflict situation the same as we would analyze any system. We would find five or so undesirable conditions. Such as, "Why is the government of X unstable" or "Why are the tribal clans of country X fighting?" Then we begin working the cause and effect issues, inserting information where available and leaving other areas blank. TOC successes in interpersonal relationships means a TOC MOOTW model is not limited to normal centers of gravity analysis. A TOC model in such a situation may uncover weak links in government personnel, economic support, personal relationships or ally support. Such a skeleton model can provide some surprising insights into a system and can prevent us taking preliminary action that may actually be contrary to our political objectives.

Notes

[1] W. Edwards Deming, *The New Economics* (Cambridge, MA.: MIT Center for Advanced Engineering Study, 1993) 95.
[2] William H. Dettmer, *Goldratt's Theory of Constraints: A Systems Approach to Continuous Improvement* (Milwaukee, WI.: Quality Press, 1997) 16.
[3] Ibid., 14-15.
[4] Ibid., 83.
[5] Ibid., 73.
[6] Ibid., 72.
[7] Ibid., 40.
[8] Ibid., 89.

Notes

[9] Ibid., 75.
[10] Ibid., 89.

Chapter 6

Final Thoughts on TOC and Military Objectives

Nothing is more difficult to carry out, nor more doubtful of success, nor more dangerous to handle than to initiate a new order of things.

—Niccolo Machiavelli

There is no such thing as staying the same. You are either striving to make yourself better or allowing yourself to get worse.

—Unknown

Air Force leaders are faced with a problem army commanders have never faced. The surface forces advance through enemy territory capturing land and forces. Finally, victory is secured when the army commander meets the enemy commander face to face to accept the enemy surrender. The winning commander needs no model to explain the effect his forces had on the enemy. The captured territory, prisoners of war and the gaunt expression on the faces of the defeated enemy tell the surface commander everything he needs to know about meeting his objectives. Often he can point to a single operation where the tide of battle turned in his favor. But what of the Air Force commander? He can lead a stunningly efficient air campaign, successfully destroying or degrading every assigned target. At the end of hostilities, he will show wonderful statistics proving unequivocally how the enemy forces and industries were degraded just as predicted. Sadly, the final questions of victory and meeting objectives will be left to the critics and historians.

An air force has the potential to cause unique effects to an enemy by attacking a full spectrum of targets throughout the state. Is it any wonder that we require a unique way to measure those effects? Military strategist Colonel Phillip Meilinger points out that what we require is a way "to measure the effects of air attacks on a complex, interconnected, and multilayered system."[1] The theory of constraints offers us such a measurement tool. TOC is complex enough to incorporate the entire strategic battlespace and flexible enough to apply to an adversary that is constantly changing to meet the military threat. Of course we must recognize that like any model, the information we enter into the TOC model will determine its ultimate success. Even with the slightest of information however, TOC allows us to begin building links from our political objectives to the targets we need to attack. The true values of TOC surface when we have a thorough understanding of the enemy. Armed with the knowledge to build a complete TOC chain, we can highlight weak links in that chain, show direct connections between potential targets and objectives, and give a future air force commander the satisfaction of pointing to a single aerial operation and saying, "It was during this attack that airpower defeated the enemy."

Notes

[1] Col Phillip S. Meilinger, "Air Strategy: Targeting for Effect," *Aerospace Power Journal,* vol. 13, no. 4, (Winter 1999): 59.

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