AD-A280 737 TATION PAGE

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE April 1994	3. REPORT TYPE AND DATES COVERED FINAL

4. TITLE AND SUBTITLE
APPLYING THEORY OF CONSTRAINTS TO STRATEGY ANALYSIS

5. FUNDING NUMBERS

6. AUTHOR(S)
JEFFREY R. RIEMER
LTCOL, USAF

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
AIR WAR COLLEGE
325 CHENNAULT CIRCLE
MAXWELL AFB AL 36112-6427

8. PERFORMING ORGANIZATION REPORT NUMBER
Unnumbered AWC research paper

DTIC
ELECTE
JUN 24 1994
S F D

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
N/A

10. SPONSORING / MONITORING AGENCY REPORT NUMBER
N/A

11. SUPPLEMENTARY NOTES
PAPER IS WRITTEN TO FULFILL ACADEMIC RESEARCH REQUIREMNTS FOR AN IN-RESIDENCE SENIOR SERVICE PROFESSIONAL MILITARY SCHOOL.

12a. DISTRIBUTION / AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)
See page iii

94-19314

94 6 23 116

14. SUBJECT TERMS
Applying, Constraints, Analysis

15. NUMBER OF PAGES
31

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT UNCLAS	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLAS	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLAS	20. LIMITATION OF ABSTRACT UL

AIR WA COLLEGE

AIR UNIVERSITY

APPLYING THEORY OF CONSTRAINTS

TO STRATEGY ANALYSIS

by

Jeffrey R. Riemer
Lieutenant Colonel, USAF

A RESEARCH REPORT SUBMITTED TO THE FACULTY

IN

FULFILLMENT OF THE CURRICULUM

REQUIREMENT

Advisor: Lt Col Mark Mondl

MAXWELL AIR FORCE BASE, ALABAMA

April 1994

DISCLAIMER

This study represents the views of the author and does not necessarily reflect the official opinion of the Air War College or the Department of the Air Force. In accordance with Air Force Regulation 110-8, it is not copyrighted, but is the property of the United States government.

Loan copies of this document may be obtained through the interlibrary loan desk of Air University Library, Maxwell Air Force Base, Alabama 36112-5564 (telephone [205] 953-7223 or DSN 493-7223).

ABSTRACT

TITLE: Applying Theory of Constraints to Strategy Analysis

AUTHOR: Jeffrey R. Riemer, Lieutenant Colonel, USAF

The objective of the paper is to spark interest in a set of thinking processes known as Theory of Constraints (TOC). This paper explains the TOC Thinking Processes, discusses the strategy development process, summarizes the 1992-1994 United States National Military Strategy, and demonstrates one of the many uses of TOC by analyzing a portion of the current National Military Strategy.

This analysis begins by hypothesizing the United States does not have a sound National Military Strategy. The rationale for this hypothesis is DOD does not have enough money in the forecasted budgets to maintain the Base Force to counter near term dangers and still invest in the Defense Technology and Industrial Base (DTIB) to provide a reconstitution capability for defeating a re-emergent global threat. This analysis concludes with the idea that by integrating the management of the DTIB, dividends are possible that provide for a sound National Military Strategy.

BIOGRAPHICAL SKETCH

Lt Col Jeffrey R. Riemer is currently an Air War College, Class of 1994, student.

Lt Col Riemer graduated from the University of Florida in 1974, earning his Bachelor of Science Degree in Aerospace Engineering and a commission through the ROTC program.

After graduating from pilot training in 1975, he had flying assignments as an F-4C Wild Weasel pilot, T-37 Instructor Pilot, and F-16 Acceptance Test Pilot.

He received his Master's Degree in Aeronautical Engineering in 1984, through the Joint Air Force Institute of Technology/USAF Test Pilot School Program. After graduating from test pilot school he served as a Test Pilot School Instructor Pilot, F-16 Experimental Test Pilot, and Operations Officer of the F-16 Combined Test Force.

Lt Col Riemer's next assignment was as a Military Staff Assistant for the Deputy Director, Defense Research and Engineering/(Test and Evaluation), at the Pentagon, from November 1988, to September 1991. This position involved the oversight of the Military Services' developmental test and evaluation of major aircraft, missile, and electronic warfare programs.

Lt Col Riemer's Pentagon assignment was followed by a tour as squadron commander of the 4953rd Test Squadron, flying NT-39 and NC-141 testbeds from September 1991, to July 1993.

Following Air War College Lt Col Riemer is scheduled to assume duties as the Program Manager for the Combat Talon II, MC-130H.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

The objective of this paper is to spark interest in a set of thinking processes known as Theory of Constraints (TOC). Chapter Two presents an explanation of the TOC Thinking Processes. Chapter Three provides a discussion of the strategy development process and summarizes current National Objectives and National Military Strategy. Chapter Four demonstrates one of the many uses of TOC, by analyzing a portion of the current National Military Strategy. Finally, Chapter Five contains concluding remarks.

This analysis begins by hypothesizing the United States does not have a sound National Military Strategy. The rationale for this hypothesis is DOD does not have enough money in the forecasted budgets, to maintain the Base Force to counter near term dangers and still invest in the Defense Technology and Industrial Base (DTIB) to provide a reconstitution capability for defeating a re-emergent global threat. This analysis concludes with the idea that by integrating the management of the DTIB, dividends are possible that provide for a sound National Military Strategy.

CHAPTER II

THEORY OF CONSTRAINTS OVERVIEW

What Is It

Theory of Constraints (TOC)[1] is a set of scientifically based thinking processes used to solve organizational problems of all types and sizes. TOC provides a methodology for identifying core problems and developing, analyzing, and implementing workable ideas to achieve on-going process improvements. TOC also provides a structured way to logically develop better understanding of what is going on in ones area of responsibility and test the decisions, policies, strategies, etc., that direct ones actions. TOC can help prevent bad ideas from being implemented, make sure meaningful ideas do not lead to negative side effects, and ensure that good ideas become more rounded. It is a powerful way to think through an issue and present an analysis in a way that strengthens relationships and builds mutual respect.

How It Works[2]

The TOC Thinking Processes are manifested in five techniques, which provide a series of linked steps that answer three fundamental questions. The three questions are:

---

[1]Theory of Constraints (TOC) was developed by Dr. Eliyahu M. Goldratt, an Israeli physicist.
[2] Chris Waddell, Consulted by author, 13 December 1993 through 31 March 1994, by telephone calls and facsimiles (Waddell Consulting Inc, & Avraham Y. Goldratt Institute, 1993-1994).

1. What to change?

2. To what to change?

3. How to cause the change?

The five techniques are:

1. Build a **Current Reality Tree** - This technique involves identifying the undesirable effects (UDEs) present in a given area, and uses experience (intuition) to connect these UDEs through cause-effect relationships. This technique helps to pin-point root causes and core problems. This provides a logical picture of reality and helps to "understand what is going on around us today."[3] Visualize the Current Reality Tree by thinking of the undesirable effects as the leaves on a tree, the cause-effect relationships as the limbs, and the root causes and core problems as the roots of a tree. By identifying a core problem it allows one to answer the first question--What to change?

2. Build an **Evaporating Cloud** - Once a core problem is identified this technique involves grouping several items together to form a "cloud." These items include a precisely stated objective, which is opposite of the core problem; the requirements and the prerequisites that make the necessary conditions for the objective true; and the conflict between the prerequisites perpetuating the core problem. Each of these items are connected by underlying assumptions. To "uncover assumptions that are limiting ones actions"[4], one evaporates the "cloud" by challenging the assumptions that are invalid, and ideas begin to

---

[3] Chris Waddell, <u>Total Quality: Bringing It Home With *The Theory of Constraints*</u> (Cincinnati: Waddell Consulting Inc. & Avraham Y. Goldratt Institute, 1993), 1-4.
[4] Ibid.

3

emerge which allow one to change the current reality and move toward tomorrow.

3. Build a **Future Reality Tree** - This technique allows one to "create a vision of tomorrow"[5] by constructing ideas (injections) which, when implemented replace the existing UDEs from the Current Reality Tree, with desirable effects (DEs) without creating devastating new UDEs. To prevent the creation of new UDEs an integral portion of this technique involves performing "Negative Branch Reservations." These Negative Branch Reservations help to show what negative effects may occur from implementing the new ideas. The Future Reality Tree is completed by injecting additional ideas to replace the negative effects with DEs. By combining the results of the previous technique and this one (techniques 2 and 3), one can answer the second question--To what to change?

4. Build a **Prerequisite Tree** - This technique involves using collective expertise to point out obstacles that are expected when implementing the injections used in the Future Reality Tree. Intermediate objectives are used to "overcome the corresponding obstacles."[6] Overcoming these obstacles allows one to implement the corresponding injections and move toward the vision of tomorrow.

5. Build a **Transition Tree** - This technique involves constructing a detailed implementation plan, based entirely on the initiator's actions and the desired effects. "Implementing changes is the step that completes the move toward the vision of tomorrow."[7] By combining the

---

[5] Ibid.
[6] Ibid.
[7] Ibid.

4

results of the previous technique and this one (techniques 4 and 5), one is able to answer the third question--How to cause the change?

Figure 1, shows the linking of all the techniques. However, it is important to realize they can be used together or individually, depending on the desired outcome. When used together these techniques provide a complete package to identify a problem and implement a solution. However, by using some of the techniques individually a wide variety of applications become available.

How To Use It

At this point the reader may be thinking that TOC is just a common sense decision-making process, but actually it is much more. Senior leaders often find themselves having to make decisions with limited information, and they depend to a large extent on their experience and intuition to make the best decision possible at that time. More information and time may be nice, but it is not always available.
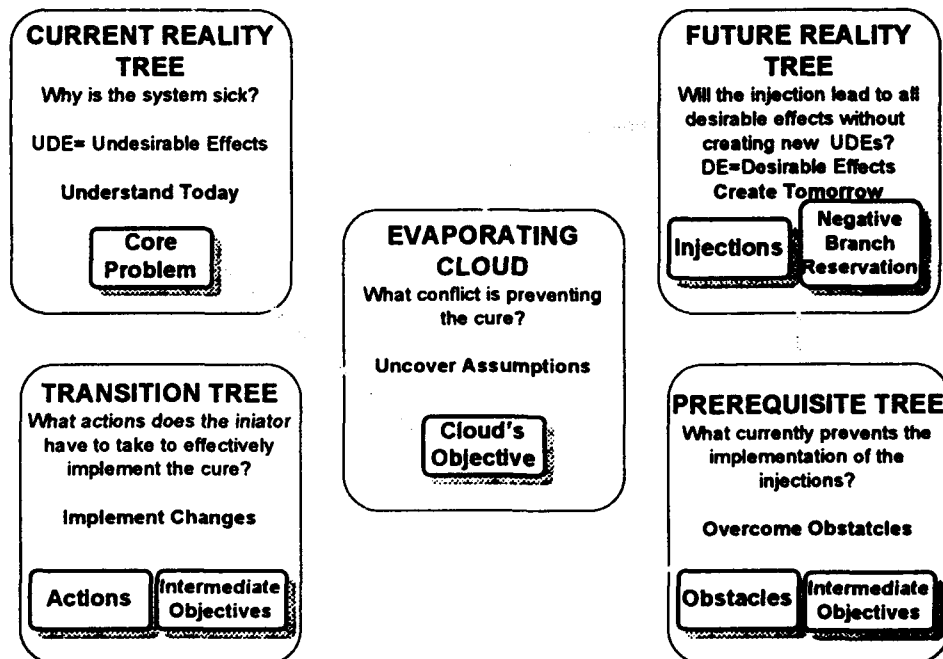
Figure 1: Linking of the TOC Techniques

When time is available it is important to use it effectively, and this is where TOC can be of benefit. If one expends resources to solve a problem, it is important to solve the problem that produces the most beneficial results. The Current Reality Tree really helps uncover relationships that show common causes that create many of the UDEs; core problems that otherwise would have remained hidden begin to appear.

Another important aspect is many times paradigms are based on assumptions that have become invalid. By using the Evaporating Cloud the assumptions can be challenged in such a way that allows invalid assumptions to become more obvious, triggering new ideas that may not have otherwise surfaced.

The Negative Branch Reservations provide a means for testing the new ideas in a non-threatening way. This technique alone can produce large dividends.

This paper mentions how to use each technique, but the major focus is on the use of the Evaporating Cloud and Negative Branch Reservations to analyze strategy.

CHAPTER III

THE STRATEGY DEVELOPMENT PROCESS

AND

CURRENT NATIONAL MILITARY STRATEGY

Strategy Development Process

"The modern strategy process (in both theory and successful practice) can be thought of as consisting of at least five fundamental, interconnected, and sequential steps or decisions that define and shape strategy at each level of authority."[8] This discussion will frame the steps in the context of national strategy development; however, these steps apply to any type of strategy development.

The steps are:

1. Determine National Security Objectives

2. Develop National (Grand) Strategy

3. Develop National Military[9] Strategy

4. Develop Operational Strategy

5. Develop Tactics

This five-step process is not as simple as one might think.

---

[8] Colonel Dennis M. Drew and Dr. Donald M. Snow, <u>Making Strategy an Introduction to National Security Processes and Problems</u> (Maxwell Air Force Base: Air University Press, 1988), 13-14.
[9] Any instrument of national power can be substituted for military (e.g. economic, political, etc.).

"There are at least four factors that complicate the process."[10]

1. The seemingly neat and compartmentalized steps of the process are neither neat nor compartmentalized.

2. There is a reverse flow or feedback system within the process.

3. Numerous external factors constrict and twist the straight-line flow.

4. The process is complicated by the question of where and by whom decisions are made within the process.

Figure 2 shows how these factors combine with the fundamental steps to form the overall process.
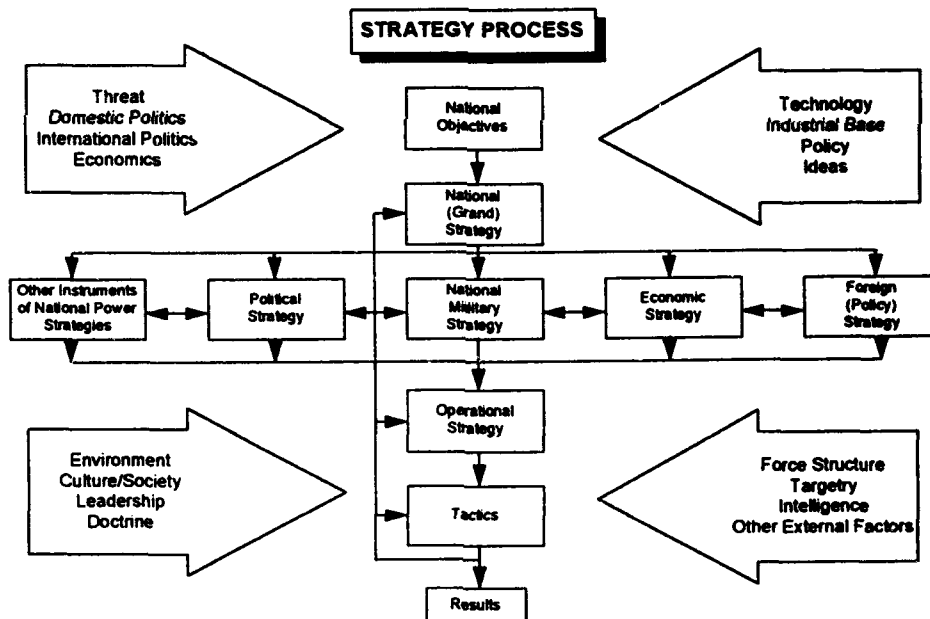

Figure 2. The Strategy Process

Internal to the overall process are the actual steps used to determine the individual strategies. The plan that best employs the

---

[10] Drew, 21. The four factors that follow have been paraphrased.

8

resources to achieve stated objectives becomes the strategy. The Snyder Model, shown in Figure 3 illustrates this internal process.
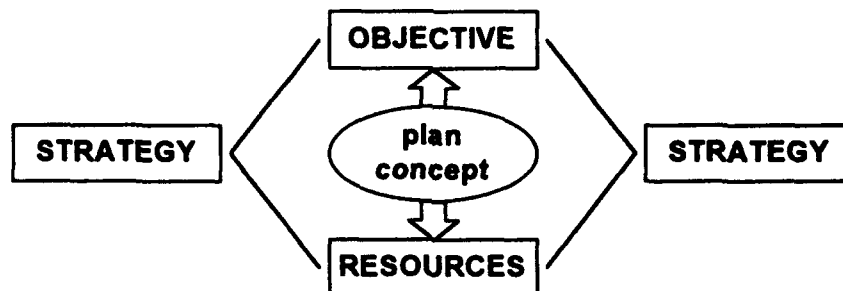
Figure 3. Snyder Strategy Model

Source: William P. Snyder, Air War College, June 1991

Several questions surface during this internal process:

1. What are the resource constraints?

2. Does strategy drive resources or do resources drive strategy?

3. What are the assumptions?

The constraints on resources can vary across a wide range, from unconstrained to fully constrained, but usually they turn out to be somewhere in the middle. The relationships between the resources and the strategy vary as a function of the constraints.

With the proper national will, resources can usually be found to do just about anything. A good example of this was the race to put a man on the moon in the 1960s. President Kennedy set the objective of having a man on the moon by the end of the decade and provided the resources that made it happen. Today, with defense downsizing the United States is put in the position of having resources constrained, which limits the available strategy options. Important points to remember are that, no matter what the level of constraints, strategy

development is not an absolute process, and in practice the process becomes iterative.

Finally--What are the assumptions? This can be the most important question of all, because if the assumptions are invalid, the strategy they produce will be flawed. The evaporating cloud technique can be very useful in testing assumptions on which to base a coherent strategy. Because The overall strategy process is complex, the better it is understood, the more useful it will prove in producing executable strategies.

Current National Objectives and Military Strategy

"The vision of the world to which the United States aspires is one of freedom, respect for human rights, free markets, and the rule of law. Defining a new strategy to achieve such a vision must begin with our national security interests and objectives."[11] They are as follows:

- The United States must ensure its security as a free and independent nation, and protect its fundamental values, institutions, and people.

- The United States will seek global and regional stability that encourages peaceful change and progress.

- The United States will seek open, democratic and representative political systems worldwide.

- The United States will seek an open international trading and economic system that benefits all participants.

---

[11] The White House, National Security Strategy of the United States, (Washington, D.C.: U.S. Government Printing Office, January 1993), 3.

- The United States will seek an enduring global faith in America—that it can and will lead in a collective response to the world's crises.

The current National Military Strategy supports these objectives using four pillars; strategic deterrence and defense, forward presence, crisis response, and reconstitution. This strategy involves letting force structure fall below what is needed to counter a global threat, while maintaining a Base Force as a core capable of strategic deterrence, forward presence, and crisis response. If a global threat starts to re-emerge leaders will use the reconstitution pillar to form, train, and field new units which will supplement the Base Force and defeat the new global threat. Figure 4 shows this concept.

The analysis in the next chapter is based on this current National Military Strategy. The strategy is expected to change, but the analysis methodology remains applicable to future strategies.[12]

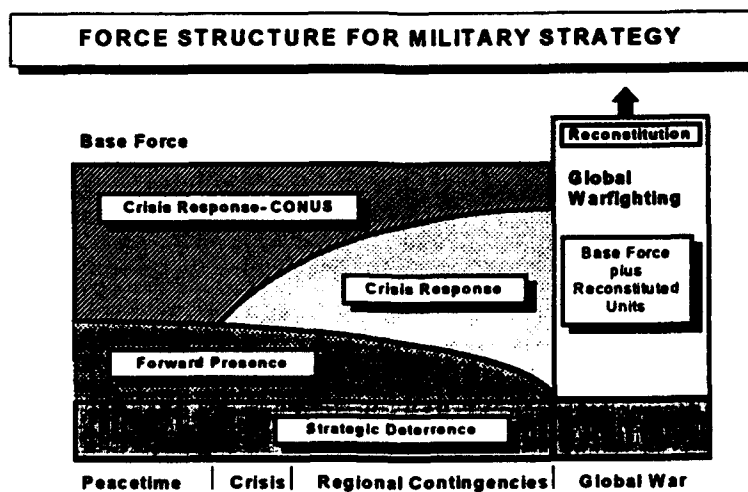Figure 4. Force Structure

Source: National Military Strategy of the United States, January 1992.

---

[12] President Clinton's National Security Strategy is undergoing final revision, and the corresponding National Military Strategy will also change.

CHAPTER IV

USING TOC TO ANALYZE OUR

NATIONAL MILITARY STRATEGY

Scope

The purpose of this analysis is to demonstrate the usefulness of
the TOC Thinking Processes in analyzing the current National Military
Strategy. The use of each TOC technique is discussed; however, most of
the attention is dedicated to applying the Evaporating Cloud and the
Negative Branch Reservation portions of the overall TOC Thinking
Processes. This helps to limit the scope while still illustrating the
usefulness of TOC in analyzing strategy.

Current Reality Tree

Normally, building a Current Reality Tree is an appropriate place
to start when using TOC. This provides a logical picture of the subject
under study and helps to understand what is going on around one today.

When developing the Current Reality Tree in search of a core
problem, it is important to take a moment and think carefully about
whose reality to use. With localized subject matter (i.e., things in
proximate control), one may be able to create a sufficient view of
reality on his own; however, for subject matter involving joint
operations or issues influenced by outside organizations, it may be
necessary to create a Current Reality Tree that combines each
organization's individual realities. Combining individual Current
Reality Trees into a single tree would provide a more realistic picture

12

of the operating environment, and may identify a core problem on the global, rather than the local level.

Creating an integrated Current Reality Tree, to determine an actual core problem, is beyond the scope of this paper. Therefore, to demonstrate how TOC applies to strategy analysis I will hypothesize a core problem.[13] Assume an integrated Current Reality Tree analysis of the current National Military Strategy produced the following core problem:

Core Problem: The current National Military Strategy is not sound.

This is not totally inconceivable, since the adequacy of each of the four pillars making up the strategy is being threatened by reductions in DOD budgets as a result of downsizing.

Evaporating Cloud

To tie the Evaporating Cloud technique to the Current Reality Tree it is necessary to form an objective, which is opposite of the core problem. To continue with the analysis, the following objective is created:

Objective: The United States must have a sound National Military Strategy.

The next step, in forming the cloud, involves selecting two requirements that meet the stated objective.

A sound current National Military Strategy must satisfy both the short and long term requirements that are fundamental to the strategy.

---

[13] This may not actually be the core problem a through analysis would produce, but it will accomplish its purpose by facilitating the demonstration of how TOC can be applied as an analysis methodology.

Sufficient force structure (Base Force) is needed in the short term to counter the near term dangers, and in the long term, the nation must be able to generate new force structure to defeat a re-emergent global threat. The following requirements satisfy the objective:

Requirement 1: DOD must have the force structure sufficient to counter near term dangers.

Requirement 2: DOD must have the ability to generate new force structure to defeat a global threat.

To continue forming the cloud one establishes a prerequisite for each of these requirements and verbalizes the conflict existing between them. The following prerequisites apply, respectively, to each of the requirements:

Prerequisite 1: DOD must invest in current force structure (Base Force).

Prerequisite 2: DOD must invest in the DTIB to provide a reconstitution capability.

The conflict is the forecasted DOD budget will not allow investment in both requirements at the levels necessary to adequately support the objective. Figure 5 shows the resulting cloud. This may initially seem rather cumbersome; however, forming the cloud helps to articulate the conflict that perpetuates the core problem.
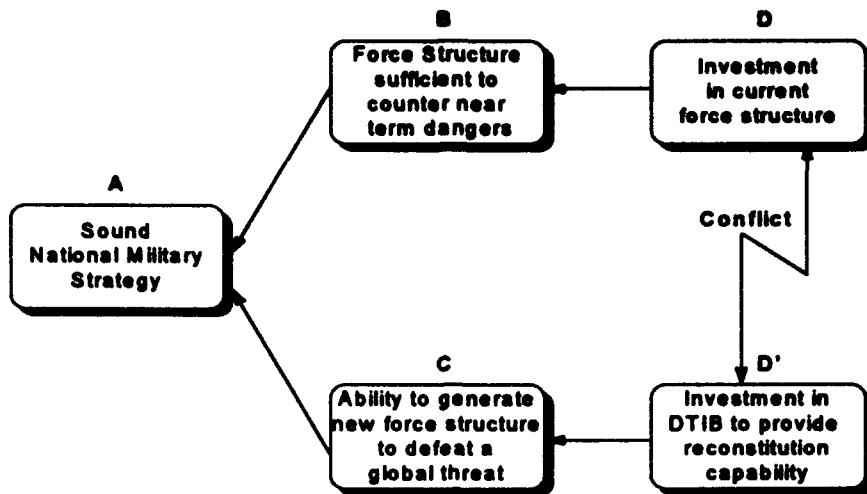
Figure 5. Cloud

To eliminate the conflict (evaporate the cloud), one must
determine the assumptions that exist under each of the necessary
condition arrows, and then search for an idea to challenge at least one
of these assumptions. The following phrase will help identify the
assumptions: In order to have "A" one must have "B," because
"assumption." Using this process yields the following assumptions under
each arrow:

A ← B: In order to have "a sound National Military Strategy" DOD
must have "force structure sufficient to meet near term dangers"
because....

- The strategic deterrence, forward presence, and crisis response
pillars of DOD's National Military Strategy depend on a strong
Base Force.

- The international environment is unpredictable.

- The United States must deter potential enemies.

- As a superpower, America is expected to lead in collective
response to the World's crises.

15

- The United States wants to ensure its security as a free and independent nation.

- The United States wants to protect its fundamental values, institutions, and people.

- Military forward presence reassures United States' allies.

A ← C: In order to have "a sound National Military Strategy" DOD must have "the ability to generate new force structure to defeat a global threat" because....

- If the United States does not have the ability to generate new force structure to defeat a global threat, then national security could be dependent upon other nations or coalitions.

- History has shown there will always be an enemy to threaten United States national interests.

- Failure to acknowledge a re-emerging global threat jeopardizes national security.

- A global threat will re-emerge.

- Force structure is decreasing below that necessary to defeat a re-emergent global threat.

B ← D: In order to have "force structure sufficient to counter near term dangers" DOD must have "investment in current force structure" because....

- Without the proper investment in the Base Force DOD will be unable to credibly counter the near term dangers.

- Lacking capability to counter near term dangers elevates national security risk to an unacceptable level.

- Forces must remain technologically superior to defeat aggressors with minimal friendly casualties.

- Force modernization is necessary to remain technologically superior and to reduce high operating costs of older weapon systems.

- Investment in readiness is essential to counter near term dangers.

- The pillars that address near term dangers are most important, since the presence of a global threat does not currently exist.

C ← D': In order to have "the ability to generate new force structure to defeat a global threat" DOD must have "investment in the DTIB to provide a reconstitution capability" because....

- The United States must partially depend upon the DTIB to reconstitute forces promptly.

- There is uncertainty in determining how long it will take for a threat to re-emerge and for forces to reconstitute.

- Allowing the DTIB to deteriorate jeopardizes national security.

- The current United States acquisition process, in this downsizing environment, will not sustain the DTIB at sufficient levels to reconstitute forces quickly.

- Lack of investment through defense contracts may cause defense contractors to get out of the defense business.

- The only present way for DOD to influence the DTIB and provide reconstitution capability is through the contracts given to industry.

- DTIB must be postured to ensure reconstitution will work.

As stated earlier, the conflict is the forecasted DOD budget does not permit investment in both the current force structure and the DTIB to provide reconstitution capability at the levels necessary to

17

adequately support a sound National Military Strategy. To eliminate this conflict any of several assumptions, that are considered invalid, can be challenged. To demonstrate this one of the assumptions under the necessary condition arrow between C ← D' is challenged.

Challenged Assumption: The only present way for DOD to influence the DTIB, and in turn reconstitution capability, is through the contracts given to industry.

Break Through Idea (Injection)

This assumption may have been valid during the Cold War, when the threat warranted investments in the DTIB via contracts. This was especially true during the defense build-up of the early 1980s when contracts were plentiful. However, with reductions in the threat the budget does not justify issuing enough contracts to industry to maintain the DTIB's excess capacity. Hence, for defense contractors to survive they are downsizing, consolidating to achieve efficiencies, and in some cases moving to commercial markets. A recent article in the Boston Globe documented defense companies taking these steps.

"McDonnell Douglas Corporation, Martin Marietta Corporation, and Raytheon Company have, in the last 12 months, shed 16 percent of its work force (14,000 workers), 23 percent (10,000 workers), and 8 percent (6,100 workers) respectively."[14] Shedding excess capacity has resulted in all three contractors showing increased earnings and share prices, but the downside is the loss of many talented workers (corporate memory). "In California alone 154,000 highly skilled workers have been

---

[14]Aaron Zitner, "In Defense of Layoffs," Boston Globe, 23 November 1993, 35.

18

lost since 1988 and an estimated 80,000 could lose jobs by the end of the decade."[15] The contractors' major concern is to show a profit, and excess capacity increases overhead, therefore they are justifiable in "...taking a knife to the payroll."[16]

"Some are buying a bigger share of the shrinking defense market...."[17] "Martin Marietta paid $3 billion for General Electric Companies aerospace division making Martin Marietta the largest defense electronics company in the world. But amid the buyout...closed 10 plants in order to become more efficient."[18] "Martin Marietta also acquired General Dynamics' Space Systems Division"[19] and is currently competing against Northrop to buy Grumman Corporation. Although, "consolidation fits with DOD's strategy to maintain a smaller but robust base of military contractors...Pentagon purchases of new weapons and equipment have declined 64 percent since 1985."[20]

The new environment of reduced DOD budgets does not permit issuing sufficient contracts to allow DOD to significantly influence the overwhelming changes the DTIB will experience. Small areas may be affected, but this will not preserve a total reconstitution capability on its own; Therefore, saying the only way for DOD to influence the DTIB is through contracts to industry, is saying DOD has little influence. However, there are other ways to influence the DTIB besides depending on issued contracts from DOD to do the job. The question to

_____

[15] Paul Schnitt, "Defense-Cutbacks Losses Dwarf State, Federal Conversion Efforts," <u>Sacramento Bee</u>, 27 February 1994, 27.
[16] ibid, 27.
[17] ibid, 35.
[18] ibid, 35.
[19] Eric Schmitt, "Consolidation of Contracts Suits the Pentagon," <u>New York Times</u>, 8 March 1994, D7.
[20] Ibid.

answer is--What can be done within our fiscal constraints to provide a reconstitution capability to defeat a re-emergent global threat?

All the players involved in shaping the DTIB and its reconstitution capability, tend to deal with their own realities which works fine for solving the localized core problem, but their actions taken to solve an internal problem may in fact conflict with the actions of the other players. Industry is taking necessary steps from its perspective to survive; DOD is losing its budget which was previously used to influence the DTIB; the White House is encouraging programs to promote technological growth; the judicial branch is looking closely at industrial consolidations with regard to anti-trust laws; and Congress is focused on near term interests to please constituents rather than long term issues. They will enact legislation to maintain jobs for displaced defense workers, but it is hard to engage them in substantive long range planning. Working separately deters achievement of common objective. One possible idea to combat this may be:

Injection: Integrate the management of the DTIB by forming an agency consisting of the players making decisions affecting the DTIB.

Before challenging the idea, it is important to consider some of the positive outcomes of implementing the proposed idea.

- Integrating the management of the DTIB would potentially influence it without investing large amounts of DOD money.

- The number of conflicting actions affecting the DTIB could be reduced.

- Reduced conflicts would make better use of limited funding within the government.

- Integrated management of the DTIB would foster a quality
environment.

- Integrated management would provide a framework to better
understand and work core problems.

- The synergistic benefit of a team approach would increase the
chances for success.

- Integrated management would facilitate identifying and
gathering necessary information to make better decisions.

- Integrated management would allow time-tracking of impacts on
DTIB--as one thing changes the impact on the time to reconstitute
could be quantified.

This last benefit provides a critical piece of information that
needs constant monitoring. Knowledge of the state of the DTIB at any
given time reduces uncertainty in determining the time needed to
reconstitute. With this information, the actual level of dollar
investments into reconstitution capability can be regulated. The
ability to defeat a re-emergent global threat boils down to the time
relationship between how long it takes for the global threat to re-
emerge, and how long it will take to reconstitute. More specifically,
the sum of the warning time (WT) that a global threat is re-emerging;
the time it takes decision makers to validate the concern and direct
reconstitution (DT); and the time to reconstitute (RT) must be less than
the time it takes for the actual global threat to re-emerge and threaten
national security (NGT). If the nation cannot control the dollars
available for investment in the DTIB's ability to reconstitute, maybe
the time factors can be controlled. As long as

$$WT + DT + RT < NGT$$

leaders can satisfy the long term requirement of defeating a global
threat. In a way, that eliminates the conflict with funding short term
requirements to have a sound National Military Strategy. This would
free up more of the limited dollars to go towards force structure to
counter near term dangers. So, by working together (integrating the
management of the DTIB), decision makers can better understand the
overall impact of individual actions and, if the impact is contrary to
the overall objective then adjustments can be pursued.

Negative Branch Reservation

With every new idea, the originator can always present the
positive side of the idea; however, it is sometimes difficult to see the
negative outcomes. Embedded in the Future Reality Tree portion of the
TOC Thinking Processes is a useful technique called "Negative Branch
Reservations," which allows a look at the negative outcomes, or UDEs
that can be caused by the new idea. After all, the intent of injecting
a new idea is to create a vision for tomorrow that is better than the
current reality. If the new idea makes things worse or no better than
they currently are, then there is no reason to implement the new idea.
The real benefit of the "Negative Branch Reservations" is that it
provides an excellent way to analyze ideas that are presented. It helps
us to "....make sure wrong ideas will not be implemented, that
meaningful ideas will not lead to negative side effects, that good ideas
will become more rounded, and at the same time do it in a way that

strengthens relationships and builds mutual respect."[21] So what are the negative outcomes of implementing the proposed ideas?

- Forming an agency adds to the bureaucracy.

- Forming an agency made up of representatives from the executive and legislative branches may be in violation of Constitutional provisions for separation of powers.

- Government teaming with industry may cause conflicts of interest.

- This agency may try to determine weapons requirements to keep certain portions of the DTIB alive, rather than meet the best needs of the military.

- This agency could lead to government control of industry if it had authority to make decisions.

- It may be hard for this agency to set common objectives, since each player is operating with a different set of constraints.

- Forming this agency may not be possible.

Now that there exist a list of the suspected negative effects this "Negative Branch" can be diagrammed by starting with an opening statement obtained from the proposed idea.   This Negative Branch is shown in Figure 6.

---

[21]   Chris Waddell, Negative Branch Reservations (Cincinnati: Waddell Consulting Inc. & Avraham Y. Goldratt Institute, 1993), 2.

This agency approach has many blockages to success

This could cause negative impact on the DTIB

It may be hard for this agency to set common objectives

Forming this agency may not be possible

This agency could lead to government influence of industry

All decisions are not favorable

We are not trying to question the policy of separation of powers

Conflicts of local interest does not support common objectives

Government teaming with industry may cause conflicts of local interests

Decisions made by this agency will influence the DTIB

Forming this agency may violate our constitutional provisions for separation of powers

Each party has its own local interests

The players consist of the President, DOD, Congress, and Industry

Forming an agency adds to the bureaucracy

Our government has a policy of separation of powers

We decide to integrate the management of the DTIB by forming an agency consisting of players making decisions affecting the DTIB

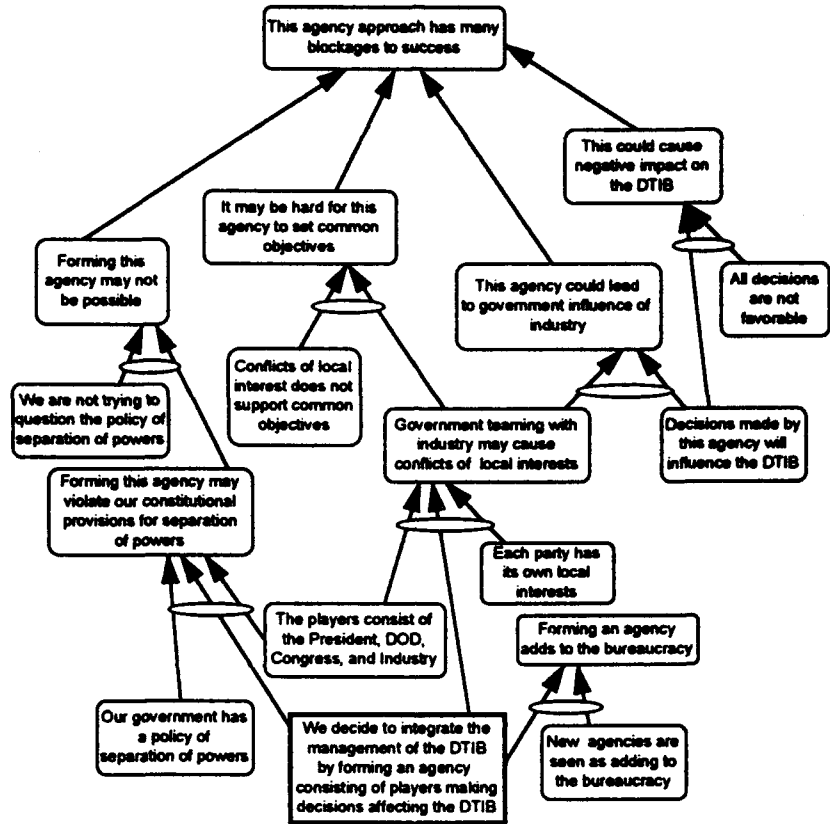New agencies are seen as adding to the bureaucracy

Figure 6. Negative Branch

This Negative Branch shows the logical connection between the proposed idea and the suspected negative effects this idea may produce. The negative branch shows that the negative effects of this idea are primarily related to forming an agency. However, if the positive outcomes associated with integrating the management of the DTIB could be realized without forming a new agency, then the vision of tomorrow could be better than today's reality and worth pursuing. This integrated management approach needs to focus on identifying and gathering necessary information to allow better understanding of how decisions

24

that impact the DTIB are affecting the time to reconstitute. Therefore, a new injection to break this negative branch could be:

New Injection: Integrate the management of the DTIB by doing a better job of linking the players making decisions affecting the DTIB.

Future Reality Tree

The Future Reality Tree could be built with this new injection, and others necessary to change the UDEs from the Current Reality Tree to DEs, to create a vision of tomorrow. Assuming this is done, it is useful to hypothesize that the Future Reality Tree shows the vision of tomorrow turned out to produce a sound National Military Strategy. By doing a better job of linking players in the DTIB decision process the nation can benefit from a more integrated approach. Decision makers will have a higher level of confidence in making sure

$$WT + DT + RT < NGT.$$

With additional injections WT could be better quantified and DT minimized since uncertainty would be reduced. Alternatives to DOD's trying to shape the DTIB solely with DOD dollars could emerge and use of other instruments of national power to increase the time for a NGT to re-emerge could be explored. For example, using the newly proposed foreign policy of enlargement leaders could better secure democracy throughout the world, and thereby reduce the likelihood of global powers being in conflict with the National Security Objectives. Fully developing an actual Future Reality Tree would answer the second question--To what to change?

Prerequisite and Transition Trees

With a vision of tomorrow the Prerequisite and Transition Trees can be used to suggest how to overcome the obstacles required to make the changes and how to implement the changes to complete the move toward a vision of tomorrow. With these steps complete the third question can be answered--How to cause the change?

This "how to" and "implementation" part of the TOC Thinking Processes is what turns ideas into reality, and is no trivial task. However, developing the details for these Trees in this paper would not add to the demonstration of TOC's usefulness as an analysis methodology. To obtain a meaningful answer to the question "How to cause the change?" one would fully developed each of the previous Trees and develop the implementation plan.

What is the Next Step?

Since the preceding analysis focused on how to apply the TOC Thinking Processes rather than implementing a solution to an actual core problem, a logical next step would be to accomplish a thorough analysis of the National Military Strategy. This analysis would be most beneficial if applied to the new National Military Strategy being developed to meet President Clinton's, about to be released, National Security Strategy. This analysis would provide an opportunity to verify the new assumptions and ideas, that produced the new strategy, satisfy the expectations of our leadership. Even though the new strategy is expected to change from the one analyzed in this paper, and a detailed analysis may produce different results, I would encourage consideration

be given to the idea of integrating the management of the DTIB by doing a better job of linking the players making decisions affecting it.

Secretary of Defense William Perry, in a presentation to the Air War College on 5 April 1994, stated "...the end of the Cold War has left the United States without a global threat, and the policy will be a pragmatic realistic approach to working with Russia and the other Republics in the former Soviet Union to prevent a reversal of the democratic and economic reforms that are underway. However, if these reforms fail, a global threat could re-emerge, and the United States will need a capable DTIB to reconstitute forces."[22] Taking steps now to integrate the management of the DTIB will provide dividends the United States can benefit from in the future.

[22] Paraphrased from speech. This speech was open to the press and did not fall within the non-attribution policy of the Air War College.

CHAPTER V

CONCLUSION

Theory of Constraints (TOC) provide a methodology for identifying core problems and developing, analyzing, and implementing workable ideas to achieve on-going process improvements. TOC also provides a structured way to logically develop better understanding of what is going on in ones area of responsibility and test the decisions, policies, strategies, etc., that direct ones actions.

Five techniques make up the TOC Thinking Processes and they help to answer three fundamental question. The Current Reality Tree helps to understand what is going on around us today to answer the first question--What to change? The Evaporating Cloud and the Future Reality Tree helps to uncover assumptions that limit ones actions and create a vision of tomorrow to answer the second question--To what to change? The Prerequisite and Transition Trees helps uncover obstacles and implements changes required to move toward the vision of tomorrow. These TOC techniques can be used in total, or in part, depending on the desired outcome.

In this paper emphasis was placed on how to use the TOC techniques to analyze the National Military Strategy, rather than implementing a solution to an actual core problem; however, I feel there is some merit in the idea this analysis produced. Integrating the management of the Defense Technology and Industrial Base (DTIB) by doing a better job of

linking the players making decisions affecting it, can help to posture the DTIB for the future. I am not proposing that the United States should nationalize the DTIB, but it is necessary to understand the dynamics involved in being able to reconstitute the forces needed to defeat a re-emergent global threat. This integrated approach would help to quantify the state of the DTIB and provide a means for tracking the impacts of decisions being made which influence its capabilities to reconstitute. Rather than trying to control the money available to execute the strategy, the control variables become the times associated with how long it takes for the global threat to re-emerge and how long it will take to reconstitute.

If United States policies are successful in preventing the re-emergence of a global threat, the significance of the time to reconstitute is decreased. If these policies fail, having an integrated management approach to the DTIB will make it possible to quantify the time to reconstitute and prevent that time from exceeding the time it takes for the global threat to re-emerge.

Change does not always produce improvement; however, for improvement to occur it must involve change. I hope this paper encourages the reader to learn more about TOC, and leads to more people applying it to deal with the changes required to meet the tough challenges that face this country in the future.

BIBLIOGRAPHY

"An Introduction of Theory Of Constraints, The Production Approach." Connecticut: Avraham Y. Goldratt Institute, 1992.

Blair, Dr. David. "Can We Plan the U.S. Defense Industrial Base?" Defense Downsizing. edited by E. B. Kapstein, 23-38. Washington, D.C.: Congressional Quarterly Inc., 1993.

Correl, John T., and Colleen A. Nash. Lifeline Adrift; The Defense Industrial Base in the 1990s. Arlington: The Aerospace Education Foundation, 1991.

Curtis, MajGen, and LtGen Thompson. "DEFENSE INDUSTRIAL BASE, Current Reality Tree, Evaporating Cloud, Future Reality Tree." Wright-Patterson Air Force Base, OH: Avraham Y. Goldratt Institute, 1993.

Defense Conversion Commission. Adjusting to the Drawdown. Washington, D.C.: Department of Defense, 1992.

DOD Acquisition Law Advisory Panel. Streamlining Defense Acquisition Laws, Executive Summary. Washington, D.C.: Government Printing Office, 1993.

Drew, Colonel Dennis M., and Dr. Donald M. Snow. Making Strategy, An Introduction to National Security Processes and Problems. Maxwell Air Force Base, AL: Air University Press, 1988.

Goldratt, Eliyahu M., and Jeff Cox. The Goal; A Process of Ongoing Improvement. 2d Revised Edition. New York: North River Press, 1992.

Lake, Anthony. From Containment to Enlargement. Speech presented to John Hopkins University, School of Advanced International Studies, Washington, D.C., 21 September 1993.

Schmit, Eric. "Consolidation of Contracts Suits the Pentagon." New York Times, 8 March 1994, D7.

Schnitt, Paul. "Defense-Cutbacks Losses Dwarf State, Federal Conversion Efforts." Sacramento Bee, 27 February 1994, 27.

"The Jonah Program." Connecticut: Avraham Y. Goldratt Institute, 1993.

The White House. National Security Strategy of the United States. Washington, D.C.: Government Printing Office, 1993.

U.S. Congress, Office of Technology Assessment. After the Cold War Living With Lower Defense Spending. OTA-ITE-524. Washington, D.C.: Government Printing Office, 1992.

U.S. Congress, Office of Technology Assessment. Building Future Security. OTA-ISC-530. Washington, D.C.: Government Printing Office, 1992.

Waddell, Chris, Consultant. Interviewed by author, 13 December 1993 to 31 March 1994, telephone calls. Waddell Consulting, Inc. & Avraham Y. Goldratt Institute, 1993-1994.

Waddell, Chris. "Total Quality: Bringing It Home With The Theory of Constraints." Cincinnati: Waddell Consulting Inc. & Avraham Y. Goldratt Institute, 1993.

Waddell, Chris. "Evaporating Cloud." Cincinnati: Waddell Consulting Inc. & Avraham Y. Goldratt Institute, 1993.

Waddell, Chris. "Sample Core Problem, Evaporating Cloud, Injection, and Future Reality Tree Analysis." Cincinnati: Waddell Consulting Inc. & Avraham Y. Goldratt Institute, 1993.

Waddell, Chris. "Negative Branch Reservations." Cincinnati: Waddell Consulting Inc. & Avraham Y. Goldratt Institute, 1993.

Weidenbaum, Murray. Small Wars, Big Defense. New York: Oxford University Press, 1992.

Zitner, Aaron. "In Defense of Layoffs." Boston Globe, 23 November 1993, 35.