The Theory of Constraints
A Process of Ongoing Improvement
The Theory of Constraints

- The Theory of Constraints (TOC): A “new” perspective on managing businesses
- TOC is based on 2 premises:
  - The Goal of a business is to achieve sustainable growth and stability, … now and into the future.
  - A system’s constraint(s) determine its output.
TOC Applications and Tools

- Drum-Buffer-Rope (DBR)
  - A method to control production and improve throughput

- Critical Chain Project Management
  - An extension of the DBR concept to project management

- Distribution and Replenishment
  - Finished Goods strategies for supply chains

- Throughput Accounting
  - A method to better manage system performance metrics

- The Thinking Processes
  - An overarching philosophy to identify and remove constraints
UTK Programs in TOC/Lean

- Customized courses and consulting at numerous sites, domestically and worldwide.

- 2-day programs on TOC
  - Nellis Air Force Base, 2018-present
  - Delta Tech Ops, 2017-2018

- 1-week course on Lean-TOC in the MRO industry
  - Public programs offered at UTK since 2007
  - Custom program at Tinker Air Force Base, Oklahoma City, 2013-present
  - Custom programs in US: Embraer, Lockheed Martin, etc., 2013-present
  - Custom programs abroad: Netherlands, New Zealand, 2013-2018

- 1-week course on Lean-TOC in Manufacturing
  - Public programs offered at UTK since 1994
  - Custom programs offered in US, Europe and Asia
Books published by UTK Faculty

  - One of two books referenced in the *Art of the Possible Handbook*

  - The first book ever published on Lean-TOC in the MRO industry
The Theory of Constraints

- TOC challenges the conventional approach to managing businesses
  - “Uncommon Sense”
  - “Cost World” vs. “Throughput World”
TOC and Uncommon Sense
TOC and “Uncommon Sense”

Examples of “Uncommon Sense” that starts to become “Common Sense” when viewed with a Systems perspective:

- “To do more work stop doing so much work!”
- “To complete projects faster, delay their start times”
Example of Systems (Uncommon Sense) Thinking: A Couple of Definitions

• A definition for Finished Goods Inventory

• A definition for Raw Material Inventory
TOC and the Cost World
Why do Organizations go “Lean?”

- Reduce costs?
  - Why do you want to reduce costs?
  - And how/where do you try to cut costs?
A Typical Breakdown of Costs in Manufacturing Industries

- **Labor:** 0 to 10%
- **Material:** 50 to 70%
- **Overhead:** 20 to 50%
Cost Cutting Strategies

- Often **focus** on reducing labor cost
  - But labor cost is a **small percentage** of overall cost and has **limited potential** to improve overall results
  - And reducing labor cost can **demoralize** the workforce

- Cost cutting strategies tend to **overlook improvements** that make you more attractive to customers (better quality, shorter flow time)
  - Often because such improvements have **difficult-to-document impact** on internal costs.
A Better Way: Lean-TOC

- A growth strategy
  - in which you **grow the business** by making the **customer** an **offer** that he can’t refuse.
  - in which you **create the capacity to grow** by the **elimination of waste**.
Lean-TOC: A Growth Strategy

- Uses Theory of Constraints thinking to identify the areas of focus. (Grow the market, eliminate waste at the capacity constraint, eliminate policies that are barriers to growth.)

- Has virtually unlimited potential.
Dr. Eli Goldratt’s Challenge to Us

“Most importantly, I wanted to show that we can all be outstanding scientists. The secret of being a good scientist, I believe, lies not in our brain power. We have enough. We simply need to look at reality and think logically and precisely about what we see.”

“Progress in understanding requires that we challenge basic assumptions about how the world is and why it is that way.”

Goldratt’s Thesis

“To live a full and meaningful life we must think clearly, and to think clearly there are four obstacles that must be overcome:

- The perception of reality as complex
- Accepting conflicts as given
- Our tendency to blame others
- Thinking that ‘we know’ ”

The work to overcome these 4 obstacles is now known in the TOC Community as The 4 Pillars of TOC.
The Four Pillars of TOC
The Four Pillars of TOC

Pillar 1: Inherent Simplicity

- The TOC community views every situation as simple!

- Problems or Undesirable Effects (UDEs) are a source of energy! They form the starting point for the Current Reality Tree, which is the first step towards understanding the Core Conflict.

- The key is to accept the core conflict as the base for understanding, not as something to be afraid of! Now we have the key to solve something significant.
Pillar 2: Every Conflict Can Be Removed

- The second obstacle is our tendency to accept conflicts as given. We live our lives accepting and dealing with compromises – compromises that are perceived to be something we have to live with.

- The TOC community does not accept conflicts as given.

- Try to better understand the **legitimate** needs on both sides and to remove any harmful conflict as soon as it appears.

  - Increasingly, a standard attitude within the TOC community.
The Four Pillars of TOC

Pillar 3: Do not blame others

- Saying that “they are the problem” is an obstacle to thinking clearly.

- People are good! Everybody wants to live a full and meaningful life.

- Question the assumptions.

- Instead of saying, “He will never accept the solution, because he is finding a problem with it,” ask instead, “This is what he said is the problem; how can I overcome that problem?”
The Four Pillars of TOC

Pillar 4: Never say “I know” the answer

- Blocks the ability to forge ahead. As soon as we think we know, we stop learning.

- A very difficult situation to improve!
  - Creates a huge dichotomy. We are supposed to be experts. Yet we want to say we do not know?

- Every situation can be substantially improved.
The Concept of Inherent Simplicity

Question 1:
Divide the white area in square A into two equal pieces

Easy!
Is it not?
The Concept of Inherent Simplicity

Question 2:
Divide the white area in square B into three equal pieces

Not so difficult!
The Concept of Inherent Simplicity

Question 3:
Divide the white area in square C into four equal pieces

Very difficult?
That’s right!
Question 4:
Divide the white area in square D into five equal pieces

Is it possible?
The 4 Square Problem

Lessons learned:

- Most of the time our mind gets conditioned so much by the circumstances that we cannot see the obvious.

- For example, when we go to see a specialist doctor with a simple headache, diagnosis starts from migraine – *upwards*!

- We assume that things are so complicated and get entrapped in the ghost of our thoughts.

- We even carry on the same syndrome to our relationships and make them complicated.
  
  - If you think that a situation is complex, you will find it is!
The Concept of Inherent Simplicity

- Complex problems do not need complex solutions. The more complex the problem, the simpler the solution should be.
  
  Eli Goldratt
There was a man who had 17 camels.

When the man passed away, his three sons opened up the man’s Will.
The Will stated that the eldest son should get half the total number of camels, the middle son should be given one-third, and the youngest son should be given one-ninth of the total camels.

As it was not possible to divide 17 camels as per the man’s wish, his three sons started to fight with each other.

Can you resolve this conflict?
The Resolution to the Conflict
Conflict Resolution: Moral of the Story

- The attitude for conflict resolution is to find the 18th camel, namely the common ground.

- Remember: Life need not be a zero-sum game!

- If you find the 18th camel the issue is resolved.

  - That can be difficult at times, but to reach a solution, the first step is to believe that there is a solution.

  - If we think that there is no solution, we will not be able to reach one!
Limiting Paradigms: The Three Illusions

- **The Illusion of Complexity:** We manage complexity by dividing the problem into component functions. Inevitably, managers have to spend time managing conflicts between these functions.

- **The Illusion of Conflict:** We set up decisions as trade-offs. Managers spend time balancing these tradeoffs, for example, growth vs stability, inventory reduction vs customer service. These tradeoffs are illusions resulting from a poor formulation of the problem.

- **The Illusion of Certainty:** We try to manage uncertainty by forecasting and planning in a *static* and *deterministic* environment. Managers expend considerable time trying to correct problems that arise when the reality doesn't match the plan.
# Blockages to Solutions & the TOC Way

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<th>The Challenge</th>
<th>Limiting Paradigms: The Traditional Approach</th>
<th>Enabling Paradigms: The TOC Way</th>
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<td>1. Illusion of Complexity</td>
<td>Reduce complexity by breaking system into component parts and optimizing each part in isolation</td>
<td>Look for the <em>inherent simplicity</em> and focus all efforts to capitalize on it (TOC Pillar 1).</td>
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<td>2. Illusion of Conflicts</td>
<td>Win-Lose. (Either we win and they lose, or we compromise.)</td>
<td>Win-Win is <em>always</em> possible; just find it (TOC Pillar 2).</td>
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<td>3. Illusion of Certainty</td>
<td>Look for formulae to calculate points of optima</td>
<td>Find a good enough solution. Use feedback to improve and sustain it.</td>
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<td>4. Managing Constraints</td>
<td>Most “constraints” are out of my control – blame others and focus on what one can control.</td>
<td>Most “constraints” are in your span of control or sphere of influence. <em>Exploit or elevate</em> these constraints.</td>
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The Illusion of Certainty: The EOQ Model

A Celebrated Model in Manufacturing

- The goal: balance inventory carrying cost ($h per unit) with ordering or setup cost ($K per order)

Can this model be misapplied? If so, how?

What is/are the right questions to ask here?
Obtaining Optimal Solutions
Under the Illusion of Certainty

It is better to be approximately correct than to be precisely wrong!
Enabling the Four Pillars of TOC

The Five-Step Focusing Process
The TOC Five Step Focusing Process

- **Step 1:** Identify the System’s Constraint(s)
- **Step 2:** Decide how to Exploit the System’s Constraints
- **Step 3:** Subordinate Everything Else to that Decision
- **Step 4:** Elevate the System’s Constraints
- **Step 5:** If a Constraint Was Broken in Previous Steps, Go to Step 1
Types of Constraints

- Physical Constraints
  - Physical, tangible; easy to recognize as constraint. Machine capacity, material availability, space availability, etc.

- Market Constraints
  - Demand for company’s products and services is less than capacity of organization, or not in desired proportion

- Policy Constraints
  - Not physical in nature. Includes entire system of measures and methods and even mindset that governs the strategic and tactical decisions of the company
Policy Constraints

- **Mindset Constraints**
  - A constraint if thought process or culture of the organization blocks design & implementation of measures & methods required to achieve goals

- **Methods Constraints**
  - A constraint when procedures and techniques used result in actions incompatible with goals

- **Measures Constraints**
  - A constraint if they drive behaviors that are incongruous with organizational goals
Effect of Performance Measures

“Tell me how you will measure me and I will tell you how I will behave.”

“If you measure me in an illogical way, ... do not complain about illogical behavior.”
Policy Constraints and “The Trinity”

The Trinity:

1. You Don’t Understand
2. We Are Different
3. That Won’t Work Here!