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Are Lean and Six-Sigma the Only Tools Needed to Ensure Military Transformation?

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Are Lean and Six-Sigma the Only Tools Needed to Ensure Military Transformation?

MORS Symposium
United States Naval Academy
Annapolis, Maryland
11-14 June 2007

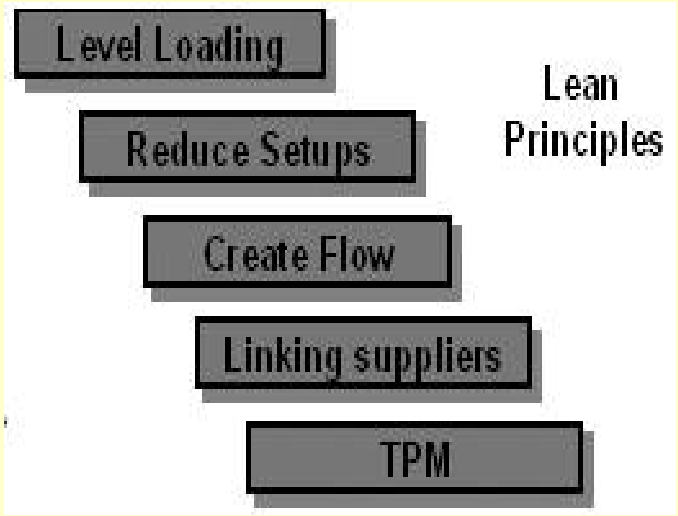
MAJ Ernest Wong
Department of Systems Engineering
United States Military Academy

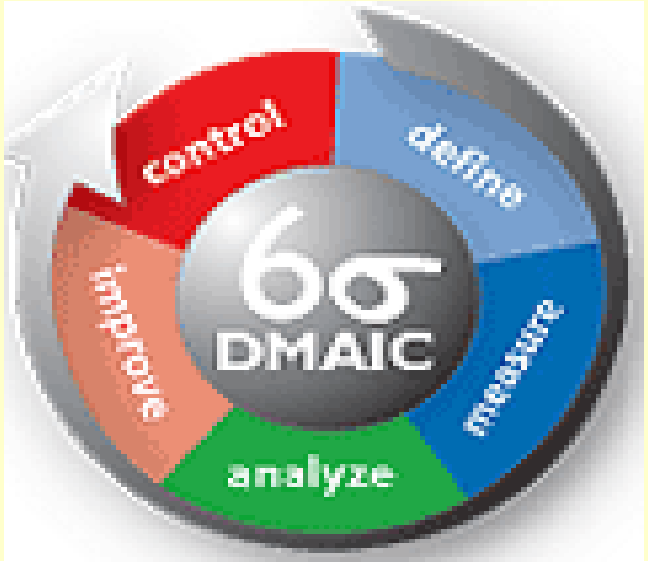
Agenda

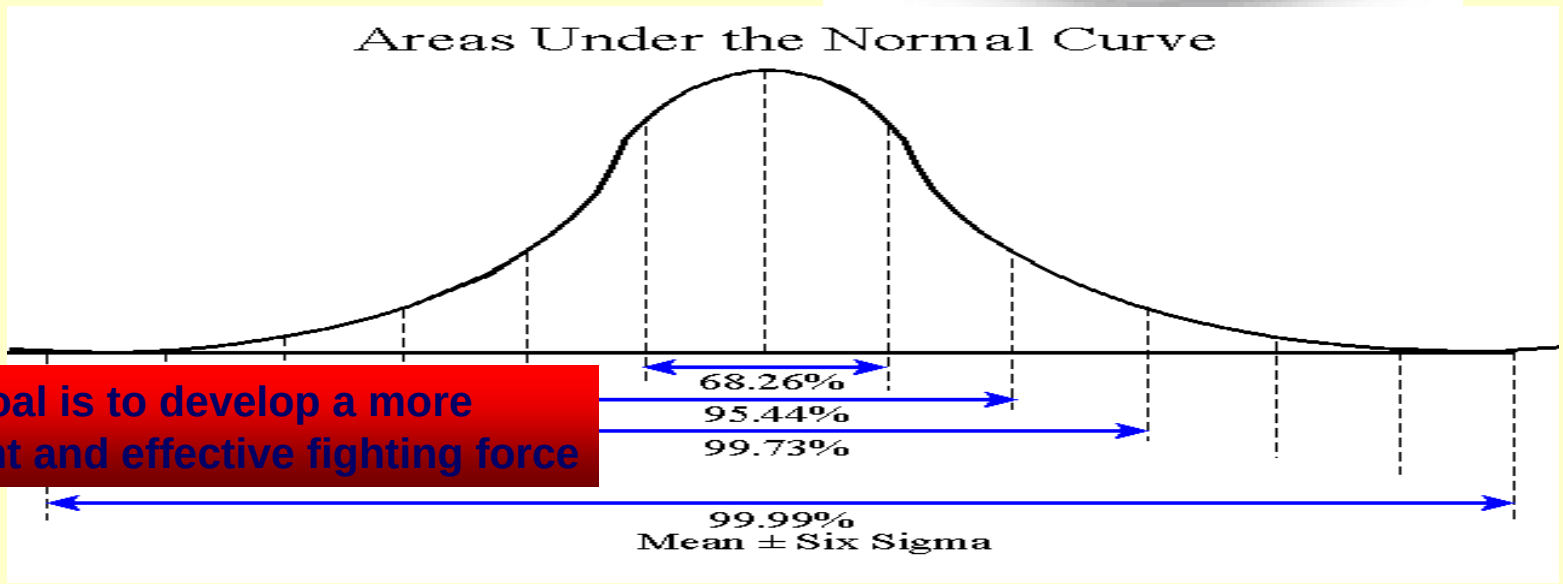
- Introduction
- Tools that Focus on Doing Things Right
  - Lean Thinking
  - Just-In-Time Planning
  - Six Sigma
- Tools that Focus on Doing the Right Things
  - Engineering Design Process Thinking
  - Just-In-Case Planning
  - Simulation
- A Yin-Yang Approach to Better
- Conclusions

Tools that Focus on Doing Things Right

Lean Six Sigma in the U.S. Army





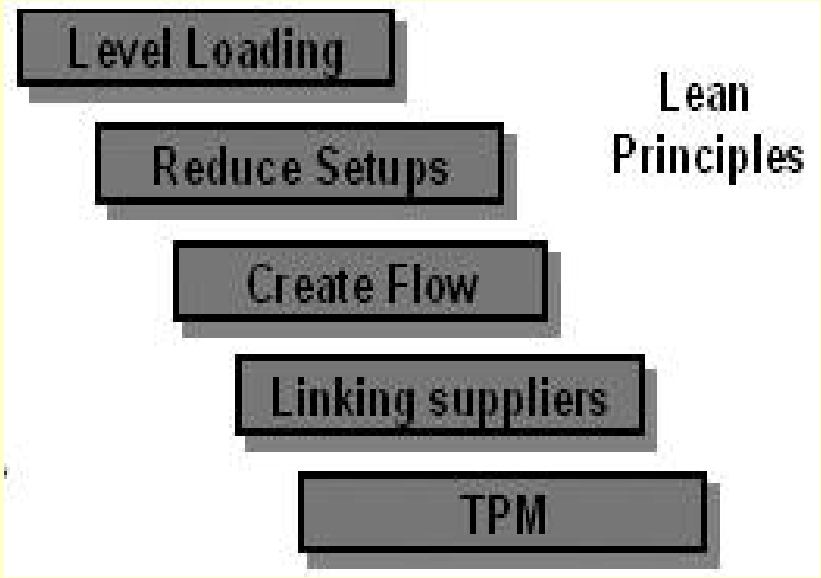


Goal is to develop a more efficient and effective fighting force

Lean / Just-in-Time Planning

Lean Techniques And Principles

- Workplace organization
- 5S
- Standardized work
- Value-stream mapping
- Team-based, multi-skilled workforce
- Kaizen events (one week)
- Jidoka (Error proofing)
- Poke Yoke (Mistake proofing)
- Just-in-time
- Cellular/Flow manufacturing
- One piece flow (takt time)
- Set-up time reduction (SMED)
- Pull system (kanbans)
- Production smoothing
- Balanced work flow
- Inventory Reduction
- Visual Management
- Waste identification & elimination (7 Wastes)
- Toyota Production System
- Total Productive Maintenance (TPM)



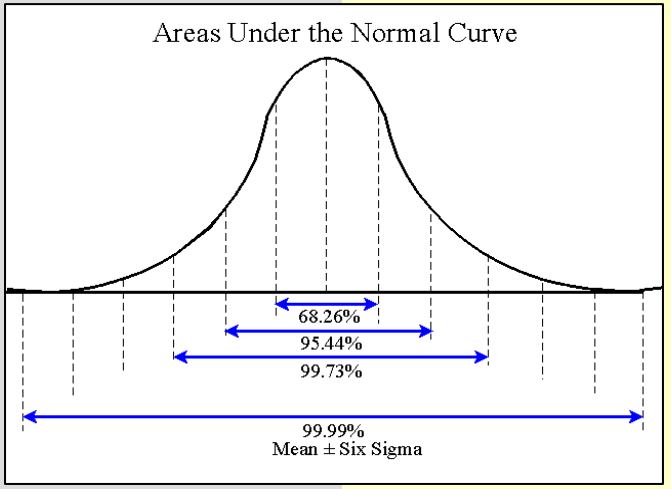
http://www.isixsigma.com/offsite.asp?A=Fr&Url=http://www.industryweek.com/CurrentArticles/asp/articles.asp?ArticleId=1247
http://www.bmqi.com/methodologies/methodologies_lean.aspx

Six-Sigma

D - Define Phase: Define the project goals and customer (internal and external) deliverables.

- Define Customers and Requirements (CTQs)
- Develop Problem Statement, Goals and Benefits
- Identify Champion, Process Owner and Team
- Define Resources
- Evaluate Key Organizational Support
- Develop Project Plan and Milestones
- Develop High Level Process Map

- Project Charter
- Process Flowchart
- SIPOC Diagram
- Stakeholder Analysis
- DMAIC Work Breakdown Structure
- CTQ Definitions
- Voice of the Customer Gathering



M - Measure Phase: Measure the process to determine current performance; quantify the problem.

- Define Defect, Opportunity, Unit and Metrics
- Detailed Process Map of Appropriate Areas
- Develop Data Collection Plan
- Validate the Measurement System
- Collect the Data
- Begin Developing Y=f(x) Relationship
- Determine Process Capability and Sigma Baseline

- Process Flowchart
- Data Collection Plan/Example
- Benchmarking
- Measurement System Analysis
- Voice of the Customer Gathering
- Process Sigma Calculation

A - Analyze Phase: Analyze and determine the root cause(s) of the defects.

- Define Performance Objectives
- Identify Value/Non-Value Added Process Steps
- Identify Sources of Variation
- Determine Root Cause(s)
- Determine Vital Few x's, Y=f(x) Relationship

- Histogram
- Time Series/Run Chart
- Regression Analysis
- Cause and Effect/Fishbone Diagram
- Process Map Review and Analysis
- Hypothesis Testing
- Pareto Analysis
- Scatter Plot
- 5 Whys
- Statistical Analysis

I - Improve Phase: Improve the process by eliminating defects.

- Perform Design of Experiments
- Develop Potential Solutions
- Define Operating Tolerances of Potential System
- Assess Failure Modes of Potential Solutions
- Validate Potential Improvement by Pilot Studies
- Correct/Re-Evaluate Potential Solution

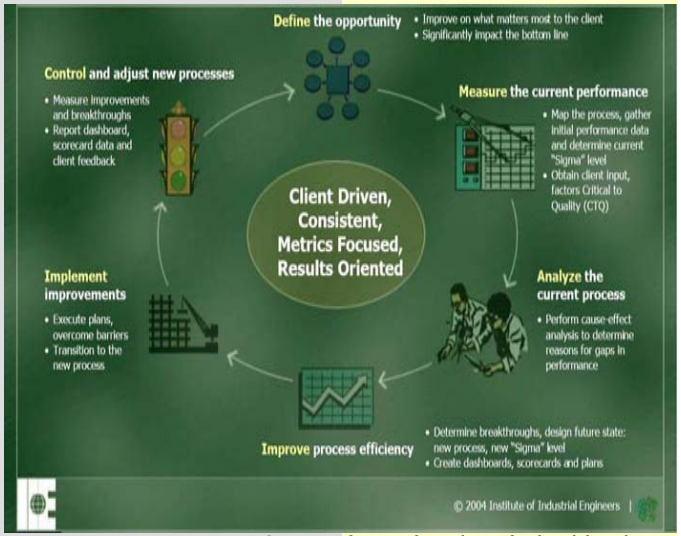
- Brainstorming
- Mistake Proofing
- Design of Experiments
- Pugh Matrix
- House of Quality
- Failure Modes & Effects Analysis
- Simulation Software

C - Control Phase: Control future process performance.

- Define and Validate Monitoring and Control System
- Develop Standards and Procedures
- Implement Statistical Process Control
- Determine Process Capability
- Develop Transfer Plan, Handoff to Process Owner
- Verify Benefits, Cost Savings/Avoidance, Profit Growth
- Close Project, Finalize Documentation
- Communicate to Business, Celebrate

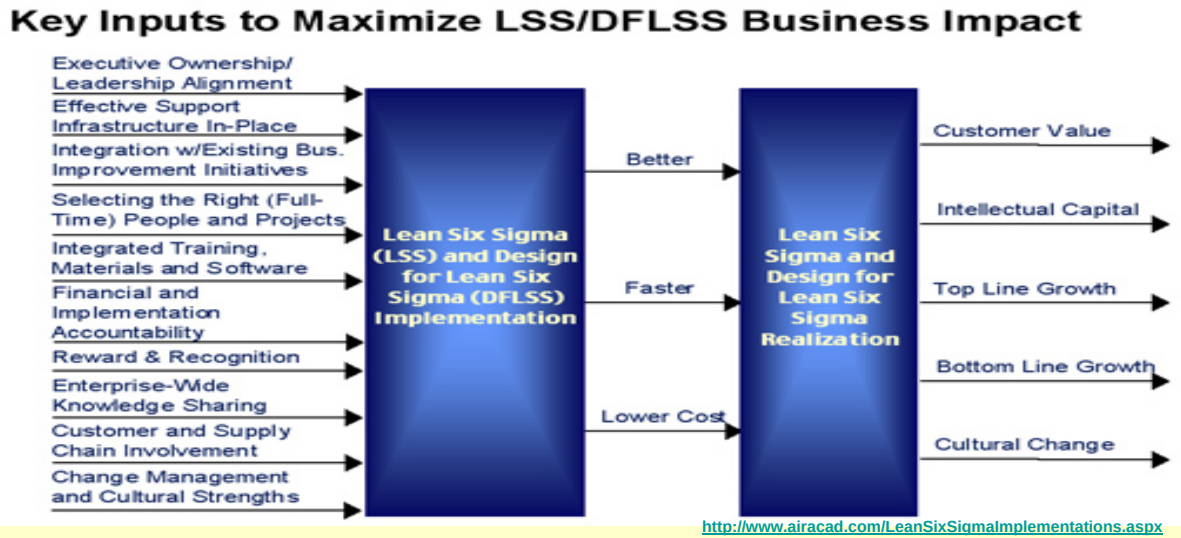
- Process Sigma Calculation
- Control Charts (Variable and Attribute)
- Cost Savings Calculations
- Control Plan

http://www.isixsigma.com/library/content/c020617a.asp

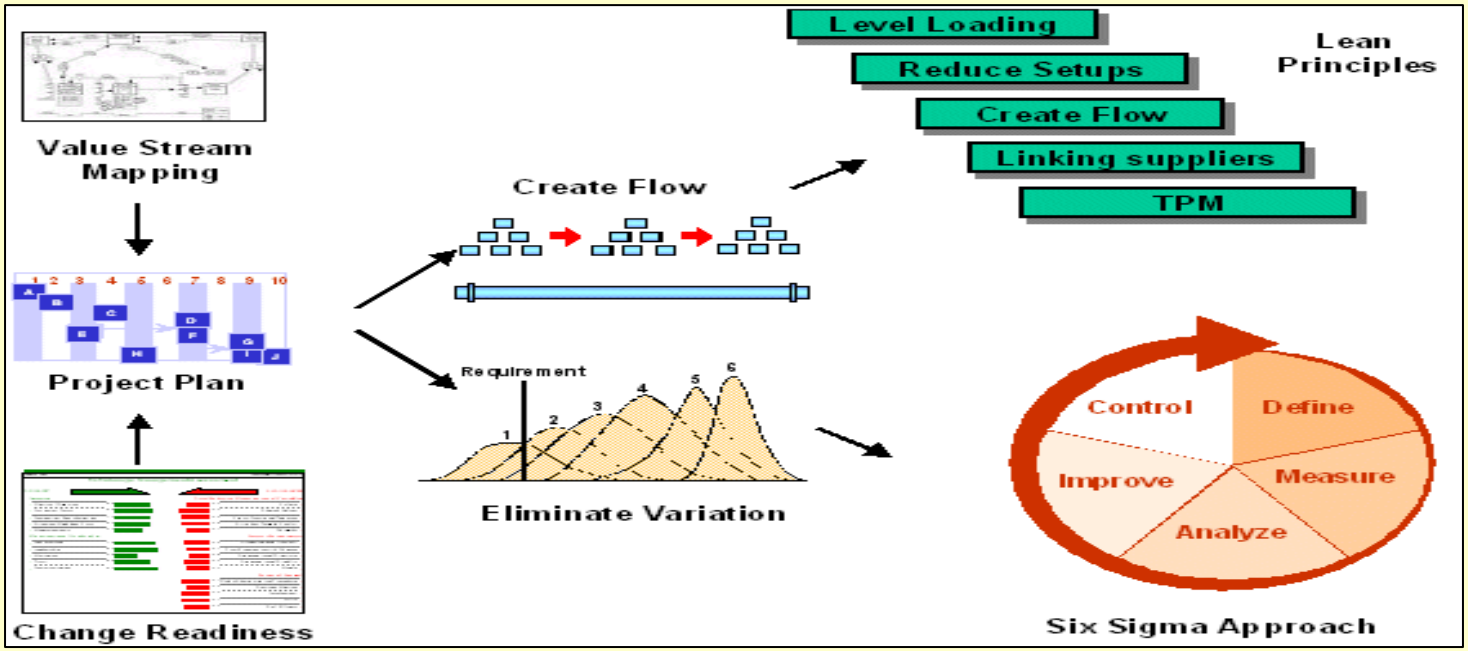


Courtesy of Larry Aft, Institute of Industrial Engineers

Lean Six-Sigma Approach



http://www.airacad.com/LeanSixSigmaImplementations.aspx



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Lean Six-Sigma in the US Army

Lean Six Sigma Achievements
Culture of Innovation

Letterkenny Army Depot

- Reduced cost by $11.9 million
- Freed up 50,000 square feet of floor space

United States Army Security Assistance Command

Foreign Military Sales

- Avoided $3.2 million in admistrative costs for FY 2005

Red River Army Depot

Heavy Expanded-Mobility Tactical Trucks (HEMTTs)

- Increased output 260% (from 5 to 18 vehicles/month)
- Decreased cycle time 75% (from 120 to 30 days)

Continuous Improvement

Armament Research, Development and Engineering Center

M915 Projectiles

- Reduced cost of munitions by 50%
- Generated $1.2 billion future cost savings

Corpus Christi Army Depot

T700 Engines

- Increased mean time between overhauls 383% (from 300 to 1450 hours)
- Reduced overhaul cycle time 69% (from 261 to 81 days)

Army Field Support Command Korea

Prepositioned Stock

- Reduced cycle time 71% for M1 tanks (from 105 to 30 days)

Tobyhanna Army Depot

AN/TPS-75 Radar

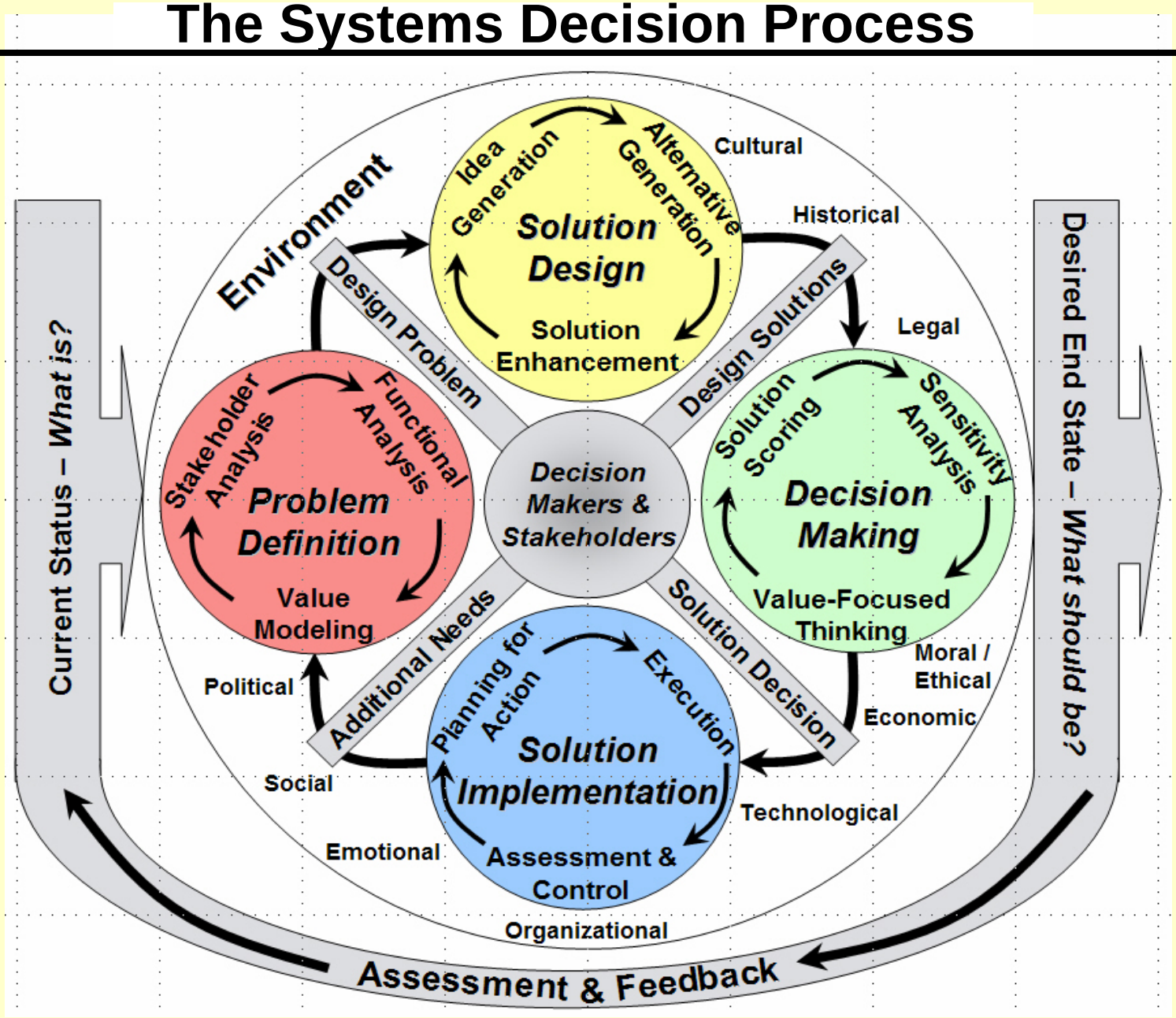
- Reduced repair cycle time 42% (from 12 to 7 months)

Source: U.S. Army Materiel Command

From Association of the U.S. Army, 2006

Tools that Focus on Doing the Right Things

The Systems Decision Process



Just-In-Case Planning

- Planning Ahead
- Having a Backup Plan
- Flexibility
- Mitigate Uncertainty
- Rapid Crisis Response

Just-In-Case Principles

"[Whereas] Just-in-Time is based on a more horizontal hierarchy, which consists of strong cooperation and interaction between works, and workers' initiative, teamwork, and multi-functionality, Just-in-Case is more appropriate for a rigid, vertical hierarchical structure, requiring workers to specialize, thus, leading, possibility, to antagonism between workers and management."

--Nurit Alfasi and Juval Portugali. 2003. *Planning Just-in-Time versus Just-in-Case*
http://www.urbanecology.washington.edu/student_info/classes/Aut2004/Alfasi%20and%20Portugali%20(2004).pdf

Simulation

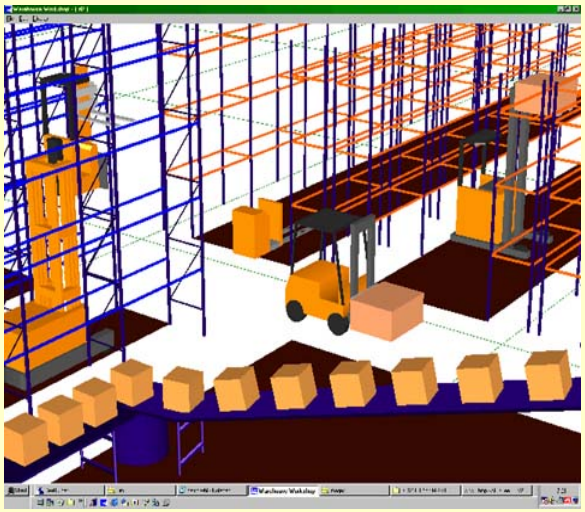
"I hear, I forget. I see, I remember. I do, I understand.

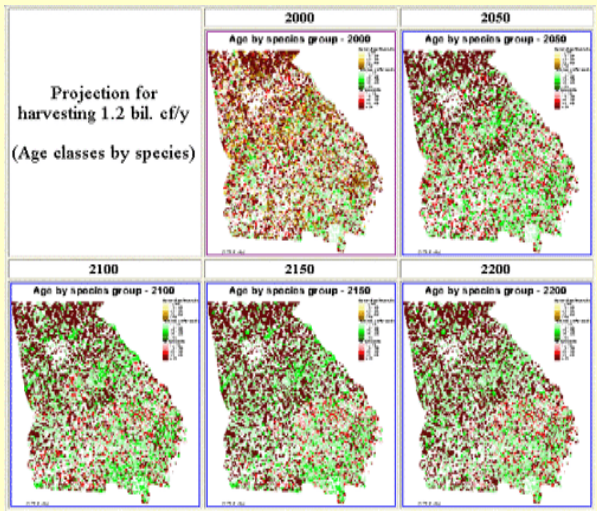
--Chinese Proverb

Simulation Applications

- **Designing and analyzing manufacturing systems**
- **Evaluating military weapon systems & their logistics requirements**
- **Determining hardware requirements or protocols for communication networks**
- **Determining hardware and software requirements for a computer system**
- **Designing and operating transportation systems**
- **Evaluating designs for service organizations**
- **Reengineering of business processes**
- **Determining ordering policies for an inventory system**
- **Analyzing financial or economic systems**

Averill Law & W. Kelton. 2000. *Simulation Modeling and Analysis*, 3rd ed., p. 2.

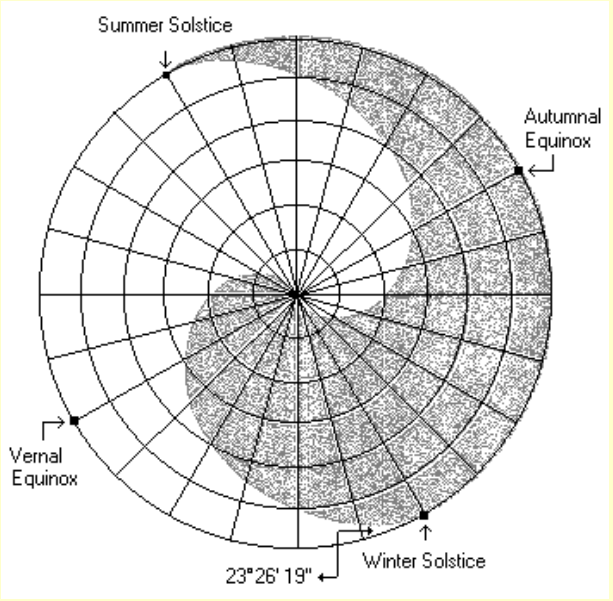




Doing Things Right
&
Doing the Right Things

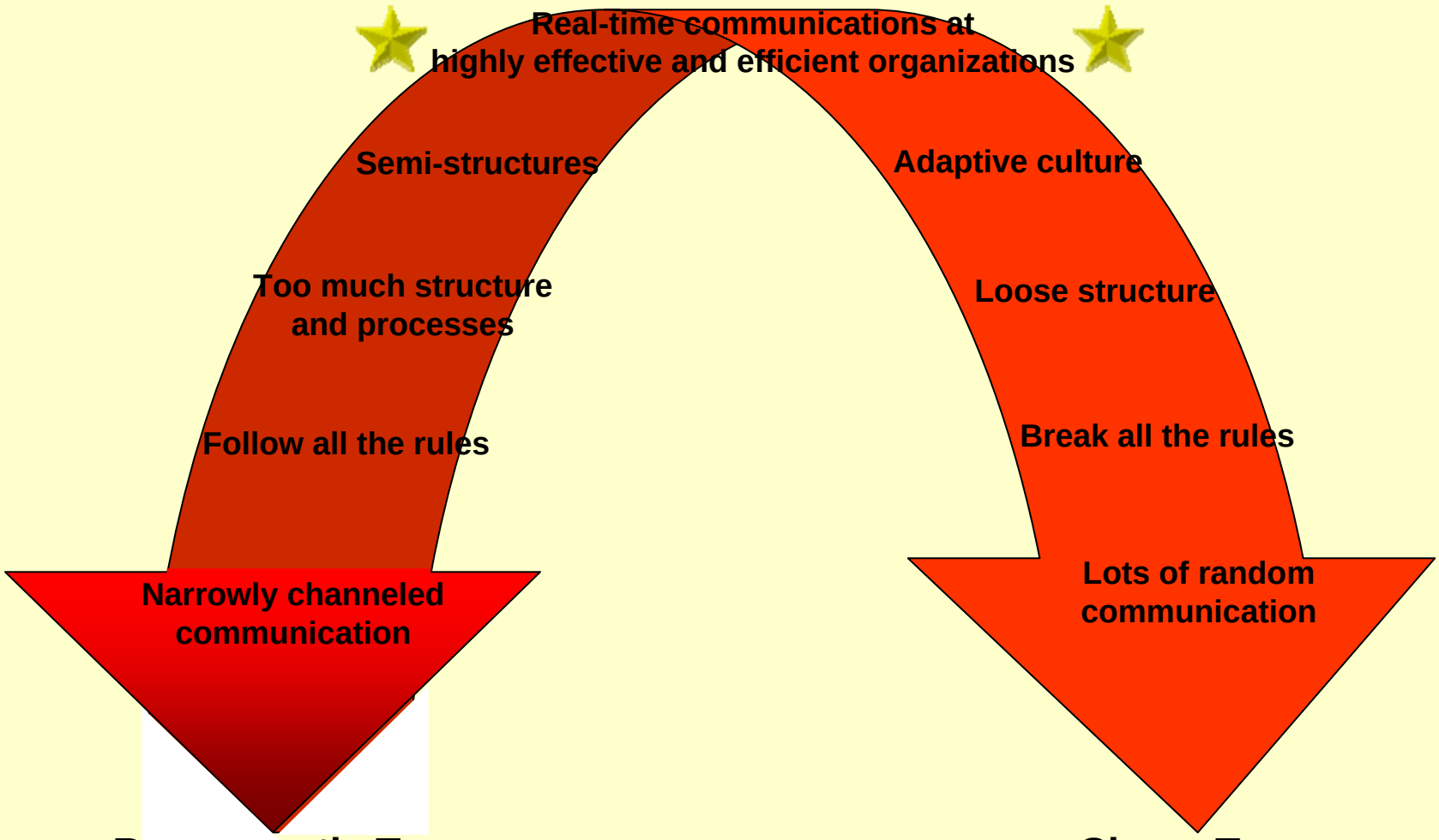
A Yin-Yang Approach to Better

- Yin (black) and Yang (white) energies co-exist in equilibrium
  - Not completely black and white
  - Opposing forces but also complementary ones
- Contrived to explain annual cycles and seasons (seminal "OR")
  - Annual calendar determined at 365.25 days
  - Calendar divided into 24 segmented cycles
  - Moon represents Yin; Sun represents Yang



- Extensions of Yin Yang
  - Fitness: Diet and Exercise
  - Finance: Stocks and Bonds
  - Education: Sciences and Humanities
  - Design: Form and Function
  - Military: "Transform to win the war today, [as well as] prepare for future challenges." –Harvey, Preston, & Schoomaker, 2006 Soldiers Almanac

Doing the Right Things & Doing them Right



Bureaucratic Trap

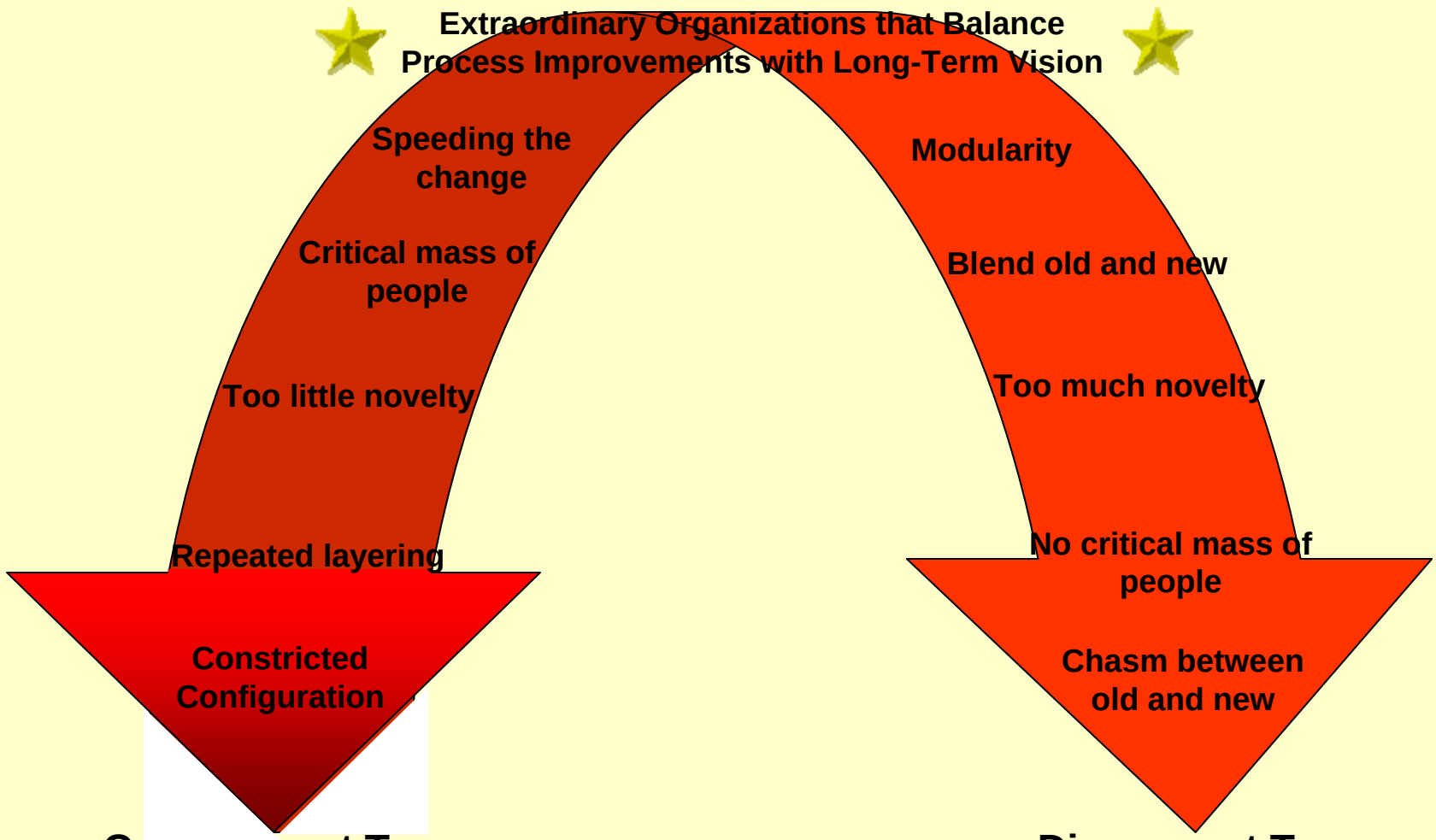
Practices become overriding concern at expense of doing what is best for the organization.

Chaos Trap

No tools at all with which to leverage and generate organizational improvements.

Chart adapted from Shona Brown and Kathleen Eisenhardt. 1998. *Competing on the Edge of Chaos, Strategy as Structured Chaos*. Harvard Business School Press, p. 30

Doing the Right Things & Doing them Right



Overconnect Trap

Practices become overriding concern at cost of innovation, creativity, and leadership.

Disconnect Trap

The lure of the latest and greatest leaves most of the organization behind.

[Chart adapted from Shona Brown and Kathleen Eisenhardt. 1998. *Competing on the Edge of Chaos, Strategy as Structured Chaos*. Harvard Business School Press, p. 94]

Notable Quotes

“Extraordinary companies keep their eyes on the long term. [These] companies have an abundance mentality. They know that if they share, if they invest in growth, if they support one another, not only will there be enough pie to go around now, the pie will just get bigger.”

--Rhonda Abrams.1999. *Wear Clean Underwear: Business Advice from Mom*

“The way to avoid mistakes is to gain experience. The way to gain experience is to make mistakes.”

--Laurence Peters. 1985. *Why Things Go Wrong: The Peter Principle Revisited*

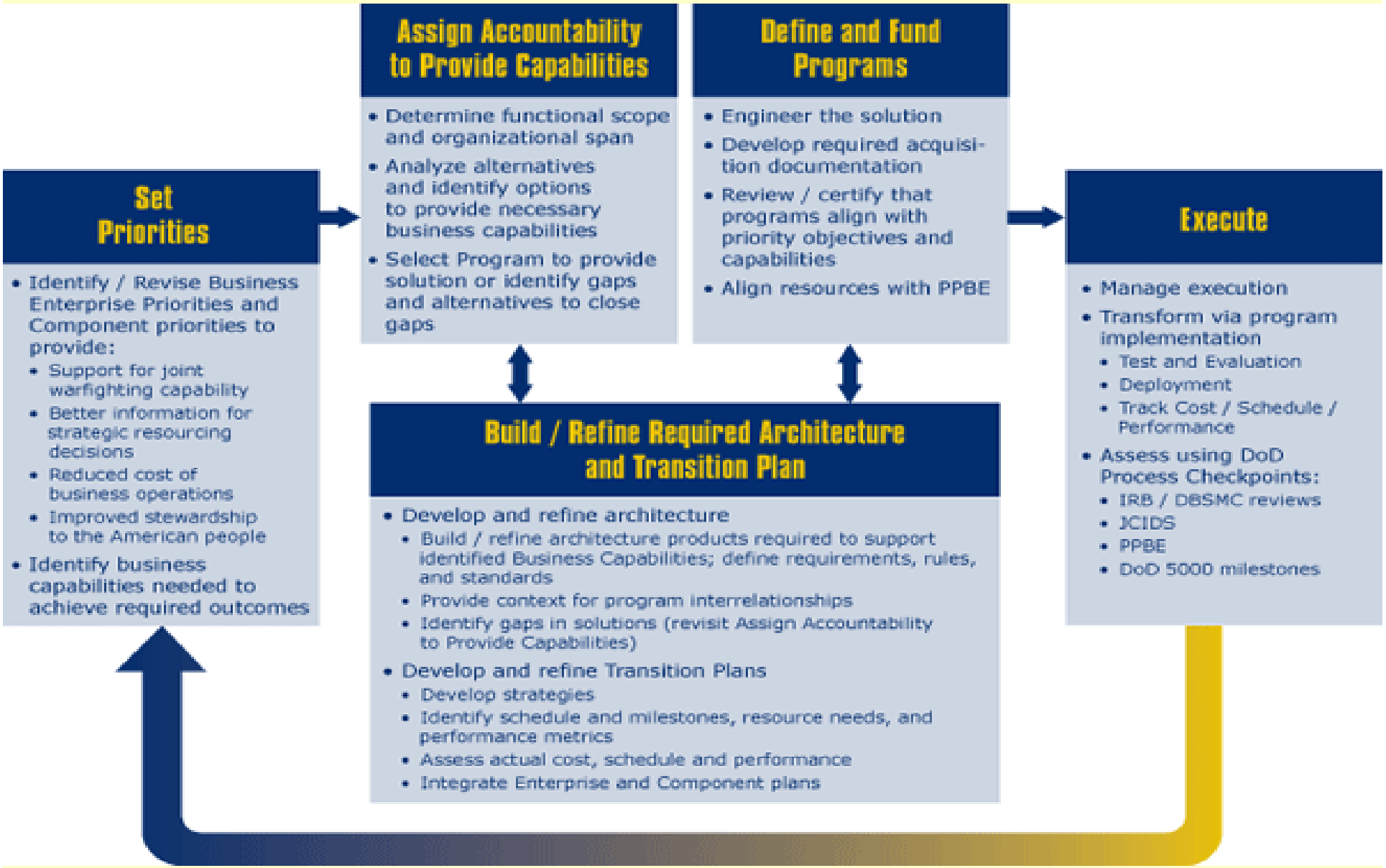
“Constantly question—even the good stuff. There's no better way to improve. . . Expect change—and plan for it. Rather than seeing it as a potential threat or problem, welcome it as an opportunity. There's no risk in preserving the status quo, but there's no profit either.”

--Michael Dell. 1999. *Direct from DELL*

“Any enterprise is built by wise planning, becomes strong through common sense, and profits wonderfully by keeping abreast of the facts.”

--Proverbs 24: 3-4. *The Living Bible*

The DOD Business Transformation Approach



From Defense Business Transformation Agency, 2006

Conclusions

While some tools help us focus on *doing things right.*

Other tools help us focus on *doing the right things.*

The key is to select, leverage, and integrate the *right tools* for the *right problems*.

Tools such as Lean, Just-In-Time Planning, and Six-Sigma can become even more powerful tools for driving organizational efficiency and effectiveness when utilized in conjunction with other tools such as Engineering Design Processes, Just-In-Case Planning, and Simulation.

"Thus it is said that one who knows the enemy and knows himself will not be endangered in a hundred engagements. One who does not know the enemy but knows himself will sometimes be victorious, sometimes meet with defeat. One who knows neither the enemy nor himself will invariably be defeated in every engagement."

--Sun Tzu

Questions?

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