

Innovative Technology =



*Customer Success*

# Dallas IIA Six Sigma Approach to Internal Auditing

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# Raytheon Overview

- Leading edge aerospace & defense company
- \$22B sales for 2007
- 72,000 employees
- Six businesses
  - Intelligence & Information Systems (Dallas)
  - Network Centric Systems (Dallas)
  - Raytheon Missile Systems (Tucson)
  - Space & Airborne Systems (LA)
  - Integrated Defense Systems (Boston)
  - Raytheon Technical Services (Washington DC)



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# Six Sigma: Brief History

The classical 6 Sigma approach, developed by Motorola, has underpinnings in producible Hardware design and manufacture.

- Ability to reproduce units of product identically and without waste
- Statistical focus; 6 sigma process = only 3.4 defects/million opportunities

The Raytheon Six Sigma™ Approach is based on benchmarking with Allied Signal and General Electric and is broader in scope

- R6S Umbrella = rigorous approach to problem solving using a 6-step process
- Philosophy of continuous improvement, including throughput improvement and defect / cycle time reduction in all business processes and products
- Integrates Proven Philosophies and a Number of Continuous Improvement Techniques and Tools
- Supported by a full time Six Sigma Expert Network
- Focused on Customer and Value Stream
- Leads to a Culture Change

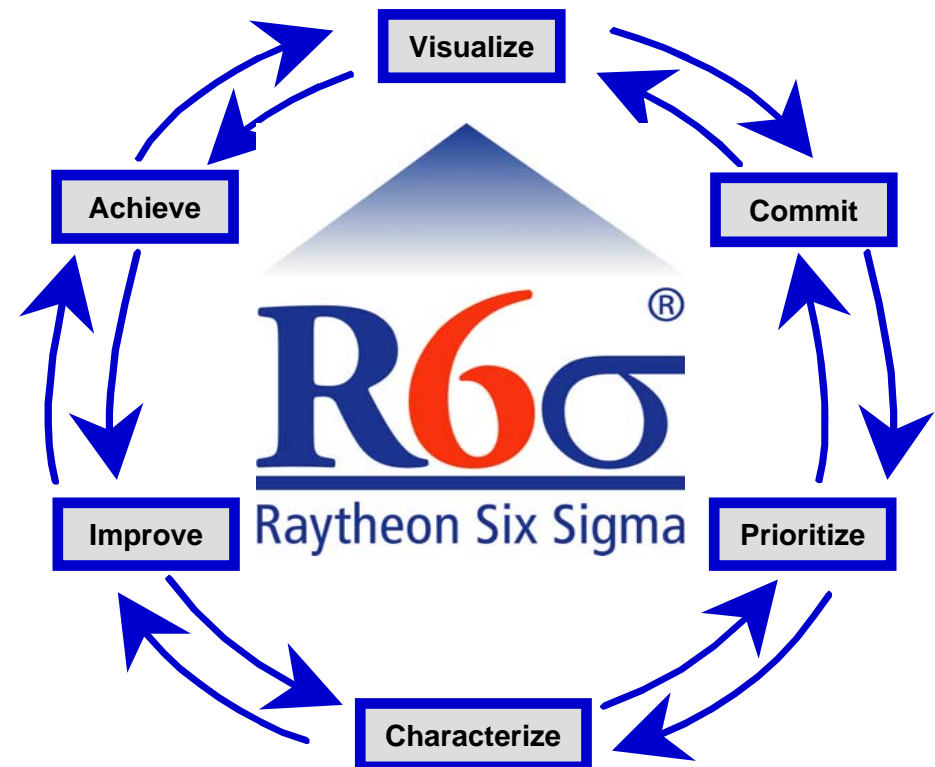


# Six Sigma: Brief History

A *Knowledge-Based Process* for *Transforming Our Culture* to *Maximize Customer Value* and *Grow our Business*

## *Act based on facts, not opinions*

- Get data, turn into information
- Take information, transform into new useful knowledge
- Take knowledge, and share to create lasting improvements



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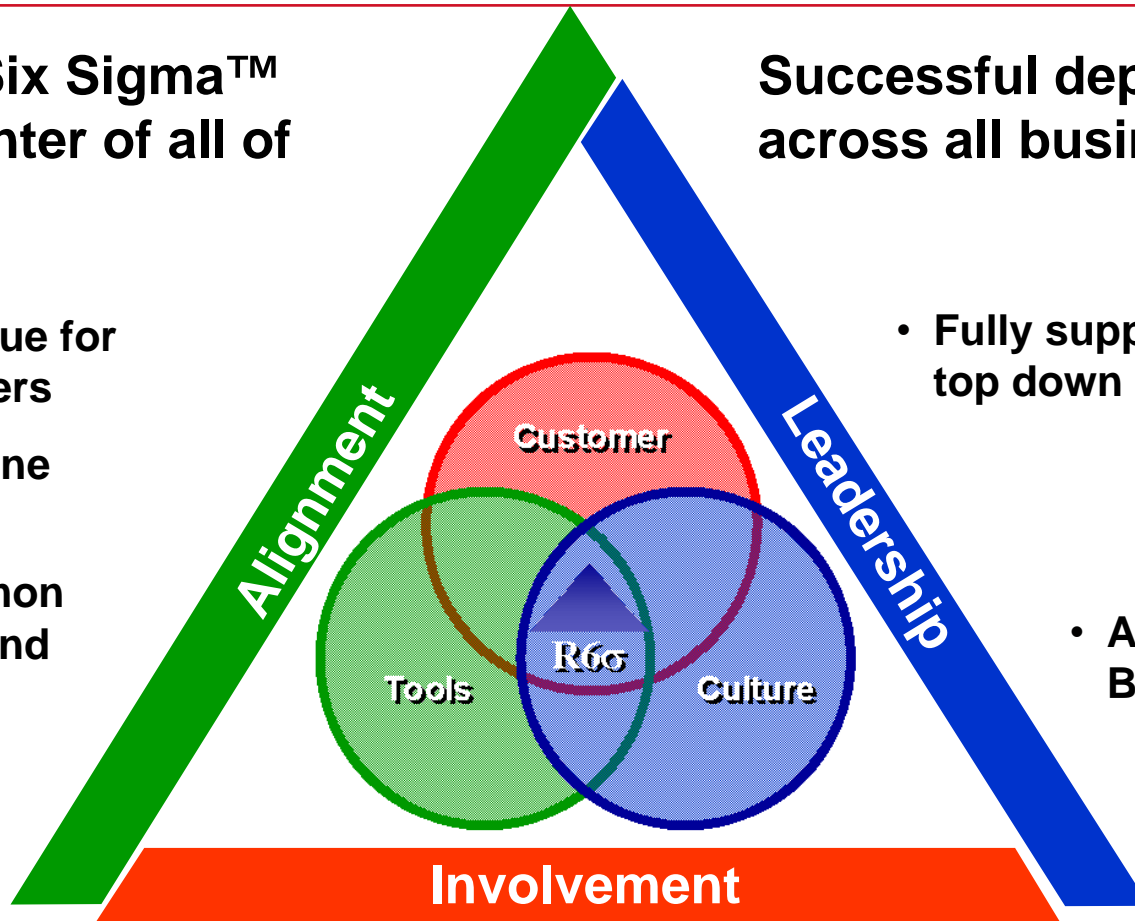
# Six Sigma at Raytheon

Raytheon Six Sigma™ is at the center of all of our efforts:

- Creating Value for our Customers
- Becoming One Company
- Using Common Processes and Tools

Successful deployment across all business units

- Fully supported, from the top down
- Aligned with Business Goals



It defines our culture — how we work



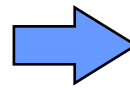
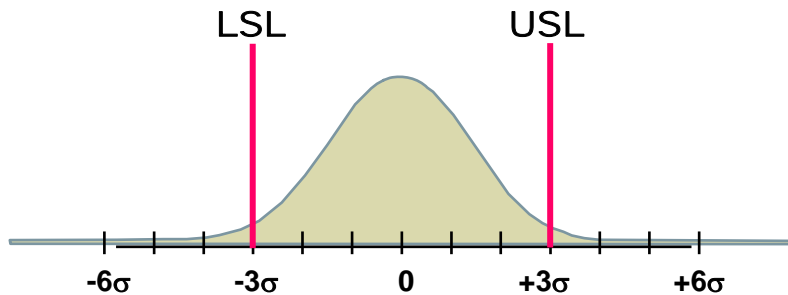
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# Six Sigma at Raytheon

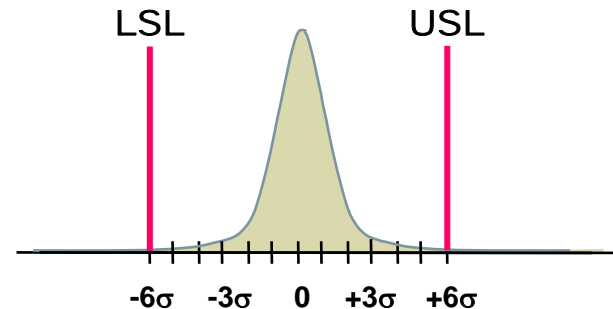
Sigma Quality Level:

The Higher the Sigma level, the Better the Quality

Three Sigma Process



Six Sigma Process



LSL: Lower Specification Limit  
 USL: Upper Specification Limit  
 $\sigma$ : measure of variation in a process  
*Specs are Customer Driven*

**Reducing Variation = Reduces Waste → Lowers Cost!**



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# Six Sigma at Raytheon

## 3 Sigma Process vs. 6 Sigma Process

3 sigma level 99.73%	6 sigma level 99.99966%
<b>8.1 Million</b> wrong drug prescriptions a year worldwide	<b>10,000</b> wrong drug prescriptions a year worldwide
Over <b>11,000</b> newborn babies accidentally dropped by nurses or doctors in USA each year	<b>Thirteen</b> newborn babies accidentally dropped by nurses or doctors in USA each year
<b>Six</b> short or long landings at Atlanta International Airport <b>each day</b>	<b>Three</b> short or long landings at Atlanta International Airport in a <b>year</b>
Almost <b>500</b> incorrect surgical operations <b>each week</b>	<b>One</b> incorrect surgical operation <b>every two weeks</b>

Three Sigma = **99.73% right** or 2,700 PPM defects (no shift)



Six Sigma = **99.99966% right** or 3.4 defects per million (with shift)



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# Six Sigma at Raytheon

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- The bottom line:
  - Improved manufacturing processes
  - Minimal defects = NO DOUBT about our product working
  - Growth opportunities enabled!
  - Knowledge sharing, best practice, constant improvement
  - \$1B in savings attributed to Six Sigma since 1999
  - Wall Street “Gets it”, real advantage over competition



# Raytheon Internal Audit Overview

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- Larry Harrington, CAE, reports to CEO and Audit Committee of Board of Directors
- Yosief Ghirmai, West Region Director
- Leading edge practice
- Organization of 43
  - 35 Raytheon employees
    - East/West Coast Directors
    - Senior Managers for each office
  - 8 Ernst & Young co-source
- Five offices aligned with our six businesses
- ~45 projects/year + management special requests
- ~90% annual internal retention rate – best in class



# How Six Sigma Transformed Internal Audit

- IA previously outsourced to Big 4
- Strong stature and independence
- Completed comprehensive and exhaustive diagnostic on current state of organization
  - Structure
  - Staff experience, competency models, mix
  - **Repeatable Process/Framework**
- Harrington hired Kathryn Bingham, R6S Expert (Black Belt) to facilitate transformation
- Instituted Six Sigma Methodology
  - Repeatable problem solving methodology that addresses root cause
  - Common language of business partners



# How Six Sigma Transformed Internal Audit

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- Internal Audit Methodology Development
  - Aligned to Company's Six Sigma Methodology and Integrated Product Development System (IPDS)
  - Audit cycles have Steps, Gates, and Phases
  - Planning Checklist
  - Reporting Checklist
  
- Enables delivery of value to stakeholders beyond assurance services
  
  
- Its all about the Current State vs. the Future State!



# How Six Sigma Transformed Internal Audit

## ■ Audit Planning

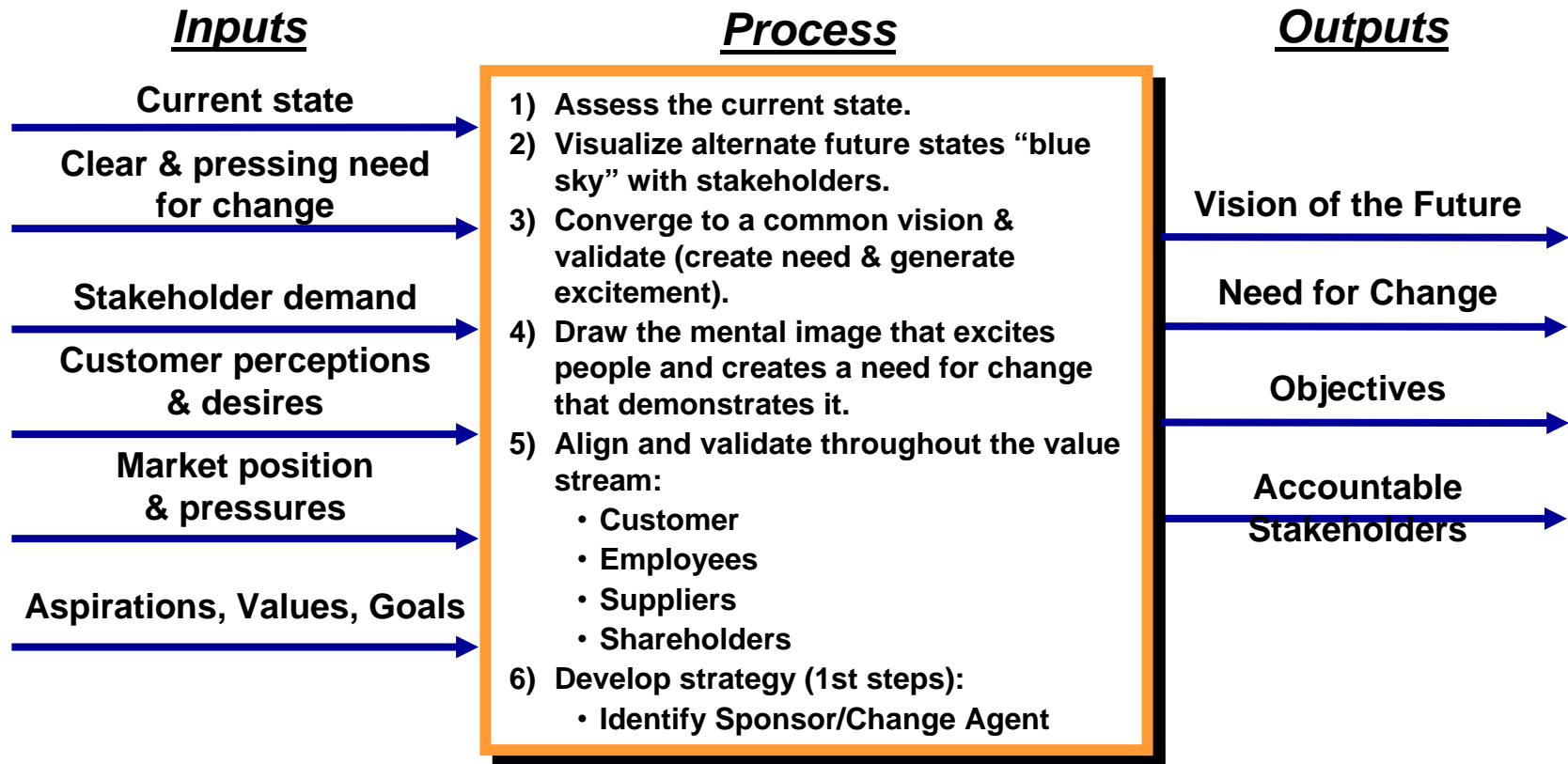
### – Establish the Burning Platform

- What is the REAL burning need for this audit?
- Why is it on the plan?
- Understand the real reasons and motivations and educate your teams!
- Data – validate the burning platform with business/process/organizational data not just anecdotal information
- The Burning Platform is the basis for the business case in the Engagement Letter, the background of the report, and for influencing without power
- Need to translate to language of our business partners



# Audit Process – Visualize/Audit Planning

## *IPO - Visualize*



## ■ Visualize the Future

- What is the ideal state of the business/function/process that we are auditing?
- How does ideal state look in terms of performance, structure, tools, systems, people, controls, risk mitigation?
- Collaborate with business stakeholders to determine vision statement if one does not exist. Leverage existing mission statements to understand ideal state.
- Partner with stakeholders to facilitate building vision statement



Vision = Focus



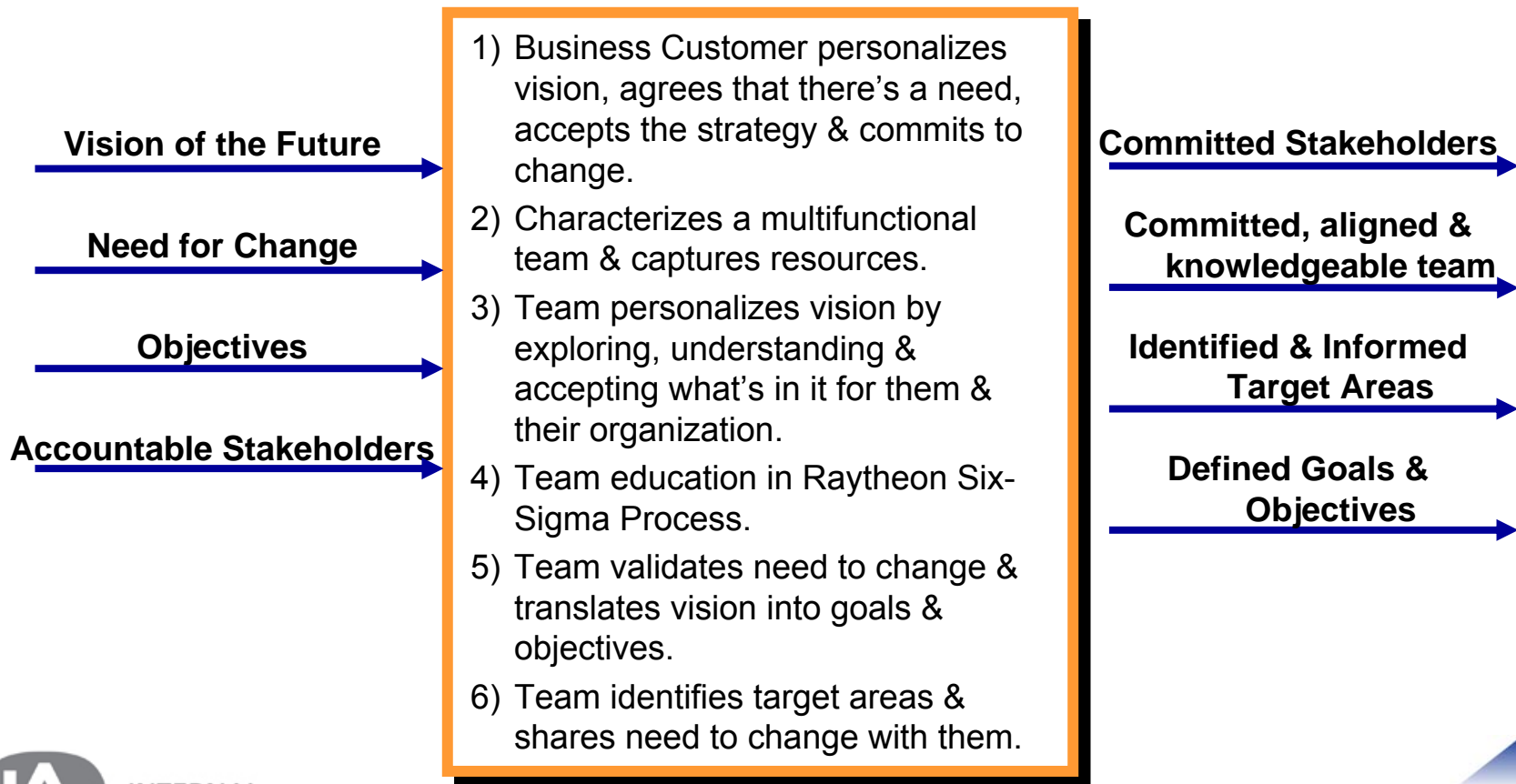
# Audit Process – Commit/Audit Planning

## *IPO – Commit: “Commit to Change”*

### Inputs

### Process

### Outputs







# Audit Process – Commit/Audit Planning Cont.

## ■ Commit

- Build your foundation, weak stakeholder commitment = audit failure
- Do you know who your stakeholders really are?
  - Develop “Responsible, Accountable, Supporting, Consult, and Inform” or “RASCI” Chart.
  - Use your network – Conduct Force Field Analysis
  - Gather some intelligence
- Gain commitment from your team
  - How was the team assembled?
  - Are competencies appropriate?
  - Are they empowered?
- Team Contract for Change and Commitment



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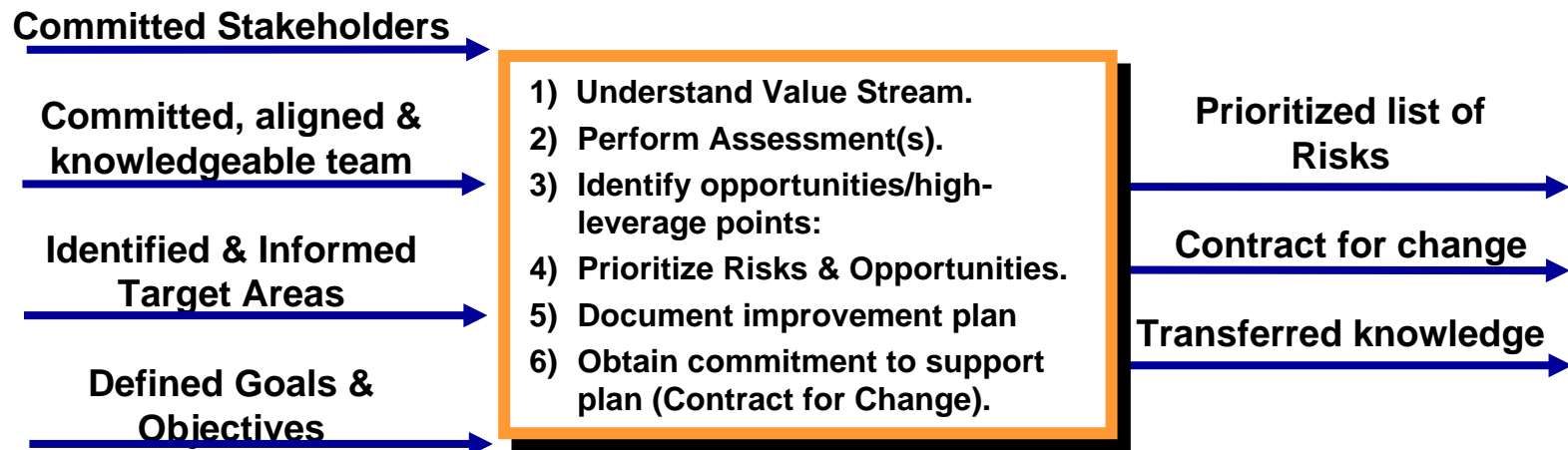
Commitment = Success

## **IPO - Prioritize** **“Determine Improvement Priorities”**

### Inputs

### Process

### Outputs



## ■ Prioritize

**Tools: Stakeholder Analysis, Facilitation, Prioritize – IPO, Pareto Charts, Team Building**

- Gather data on current state of process
- What are the Undesirable Effects that need to be addressed?
  - UDEs can be unmitigated risks, performance issues, known problems, etc
- What are the Desirable Effects that should be maintained?
- Prioritize Undesirable Effects to be addressed based on surveys, interviews, etc



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Prioritization = Value



# Audit Process – Prioritize/Planning/ Fieldwork Cont.

## ■ Prioritize

- Evaluate other potential risks
- Develop numerical risk ranking based on likelihood of occurrence and impact (\$\$\$). Provide substantiation for basis of ranking.
- Communicate via Heat Map for effectiveness
- Validate, validate, validate!
- Identify consulting/non-audit opportunities

# Audit Process – Prioritize/Planning/ Fieldwork Cont.

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Some audit departments may make recommendations at this point.

Six Sigma mandates solutions driven by data and true root causes!



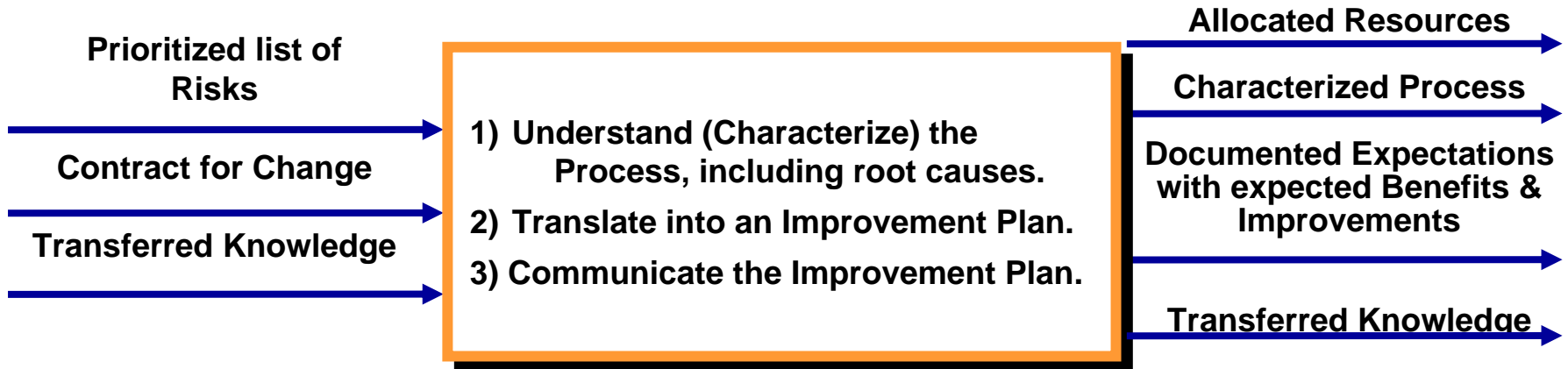
# Audit Process – Characterize/Fieldwork

## Characterize – IPO

### Inputs

### Process

### Outputs



# Audit Process – Characterize/Fieldwork Cont.

## ■ Characterize

### – Data Collection and Analysis:

- Revalidate process with contacts
- Sample selection, perform tests, document results
- Validation of observations; clarify / review as needed
- Evaluate effectiveness of controls at mitigating identified risk
- Raise issues and resolve with management

**Tools: Process Maps,  
Interrelationship Diagrams, Value  
Add Analysis; Apollo Root Cause**

# Audit Process – Characterize/Fieldwork Cont.

## ■ Characterize

### – Data Collection and Analysis:

- Identify best practices, Opportunities and Risks
- Define root causes
- What do observations imply regarding Raytheon Customer value stream (waste / variation)?
- Identify improvement alternatives

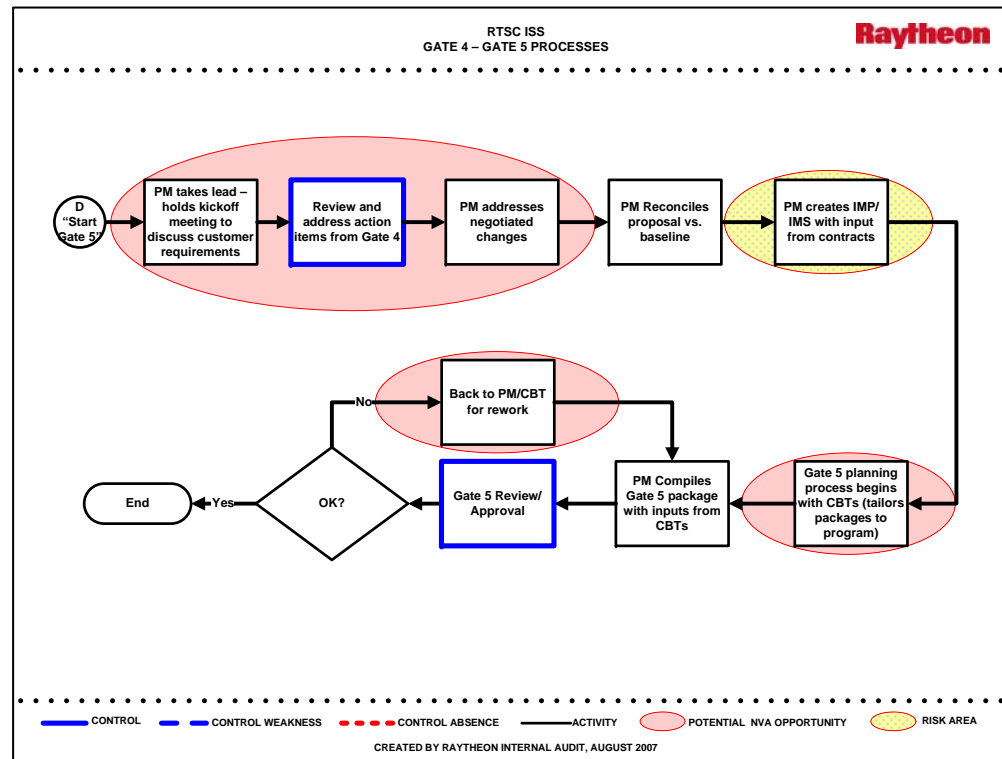


# Audit Process – Characterize/Fieldwork Cont.

## ■ Characterize

– Example: document/validate process

- Process Maps: controls, hand-offs, duplicate reviews, rework loops



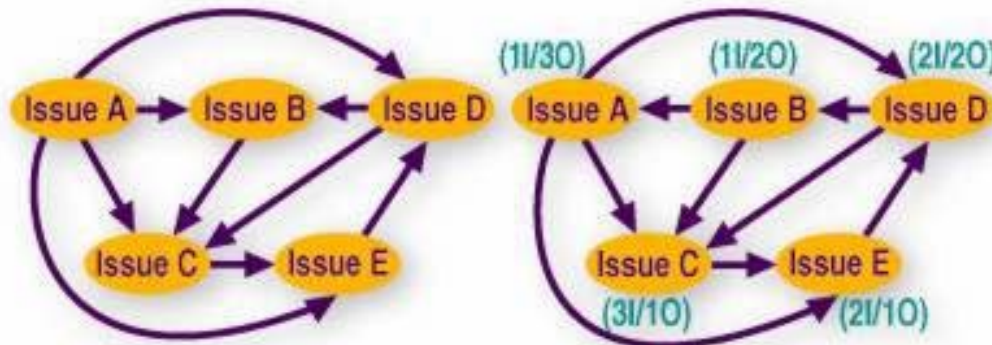
# Audit Process – Characterize/Fieldwork Cont.

## ■ Characterize

### – Example: Determining Causal Relationships

#### □ Interrelationship Diagram

- Identifies drivers of Undesirable Effects to determine initial causal relationships.



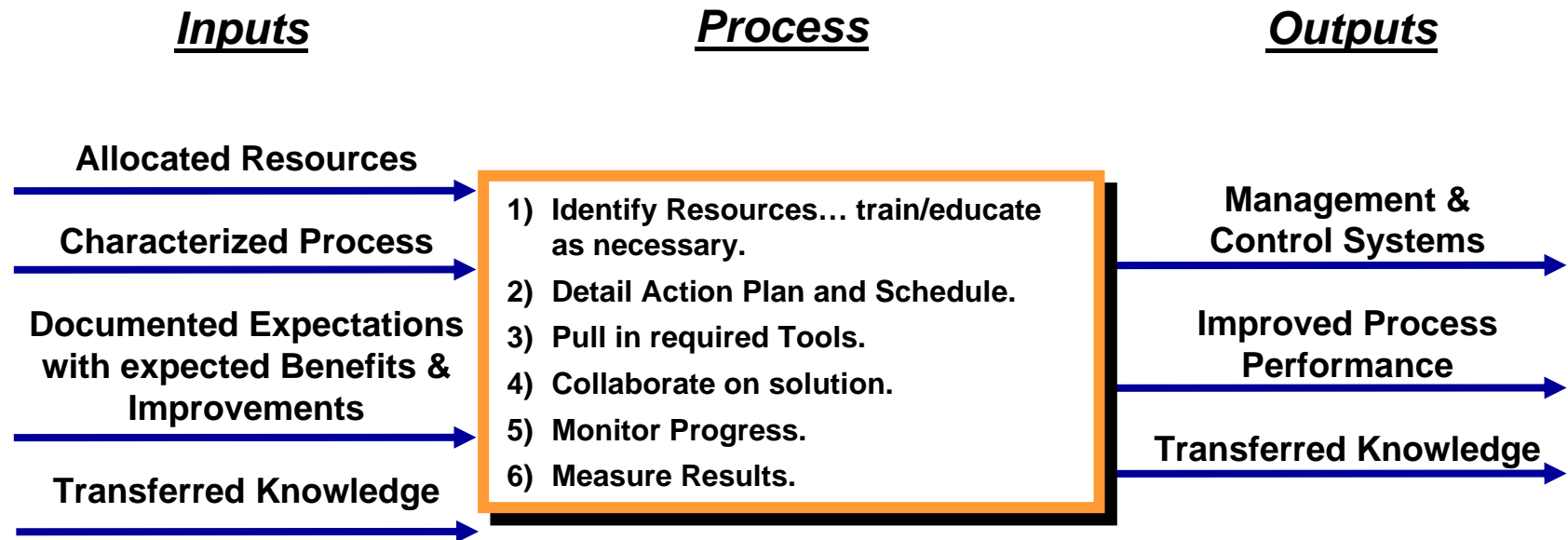
## ■ Characterize

### Example: Apollo Root Cause

- No such thing as a ‘root cause’
- Every effect has at least one action cause and one condition cause that exist at the same time
- Causes are effects of other causes – a cause and effect continuum exists
- Start at the undesirable end and work backwards through all relevant causal legs
- Focus on interrelationships between causes and effects to identify opportunities for effective solutions
- Alignment around the problem and the significance
- Incorporates key cause and effect principles
- Use of evidence to validate causes
- Effectiveness of solutions dependent on degree of acceptable risk

# Audit Process – Improve/Fieldwork/Reporting

## Improve – IPO



# Audit Process – Improve/Fieldwork/Reporting Cont.

## ■ Improve

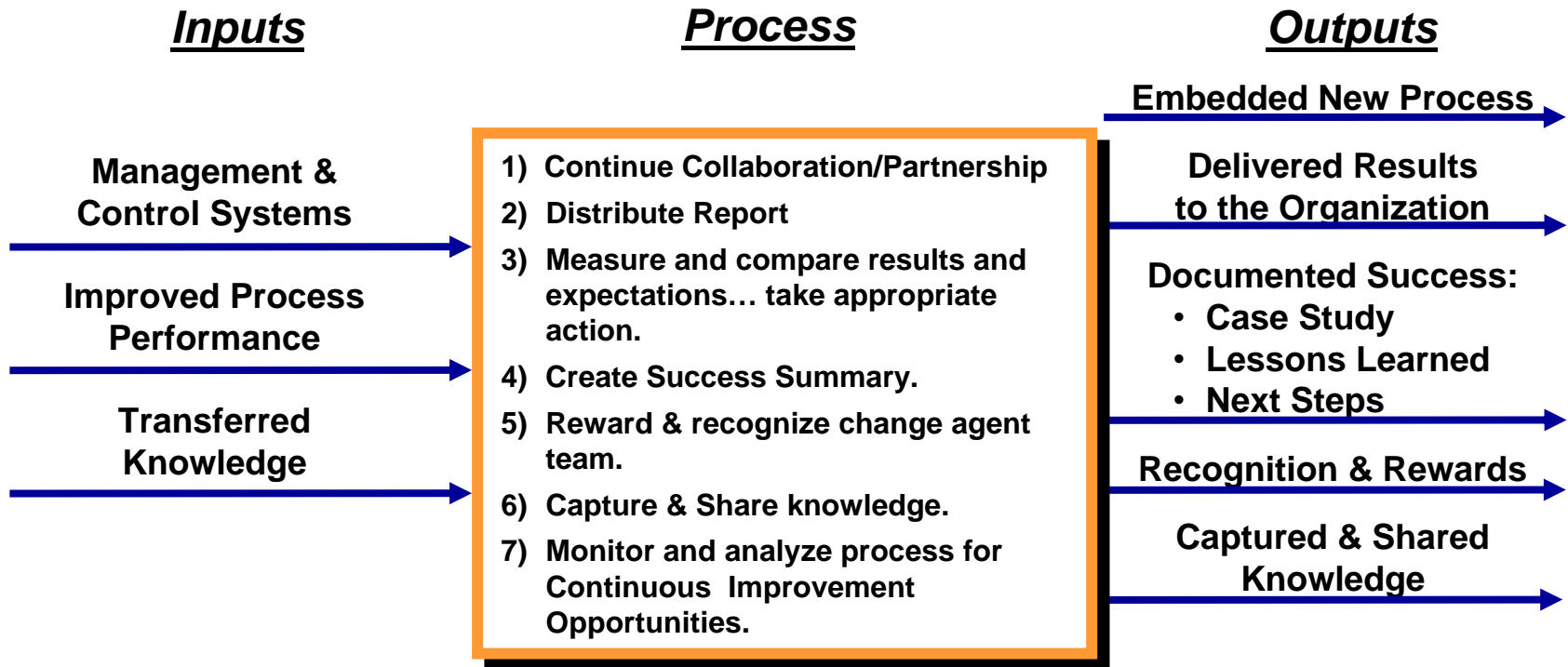
**Tools: Force Field Analysis,  
Facilitation,**

### – Stakeholder Review:

- Document testing exceptions/Validate
- Out brief on findings, including items discussed / cleared during audit
- Review process improvement opportunities
- Review preliminary management responses
- Prepare Draft Report
- Distribute draft with findings and management action plan to BU leadership prior to final distribution

# Audit Process – Achieve/Reporting

## *Achieve – IPO*



# Audit Process – Achieve/Reporting Cont.

## ■ Achieve

– Final Report:

- Issue final report
- Request survey feedback on customer satisfaction

Tools: Survey, Reporting

# Results

## Pre-Six Sigma

- Audit report issuance cycle >180 days
- Business stakeholder dissatisfaction
- Addressing anecdotal/symptomatic causes not root causes
- Very high turn over of staff
- Lack of institutional knowledge
- No repeatable process
- Weak methodology
- Not used as talent pool

## Post-Six Sigma

- Report issuance ~ 2 weeks
- High stakeholder satisfaction (average score 4.4 out of 5)
- Address true root causes
- Low external turnover
- Process for sharing and retaining knowledge
- Repeatable process for analyzing and mitigating business risk
- Leveraged as talent pool by mgmt
- Enable business growth
- Constant reassessment & change



# Results

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- Affect Company Strategy
- Multi Million \$ Savings
- Benchmarking
- Lead Efficiency/Lean Efforts
- Policy Guidance
- Change Agents
- Problem Solvers
- Consultants



# Q&A



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