

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



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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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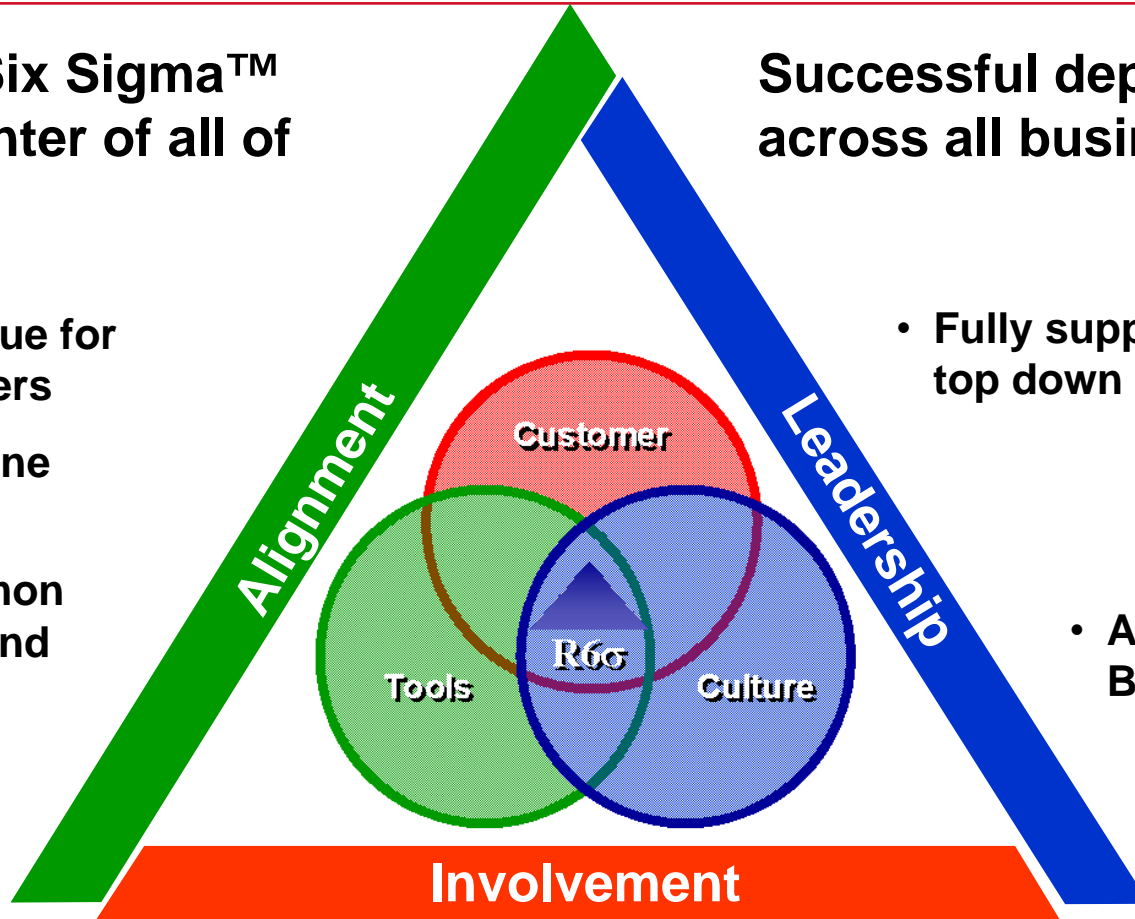
Six Sigma at Raytheon

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



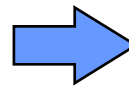
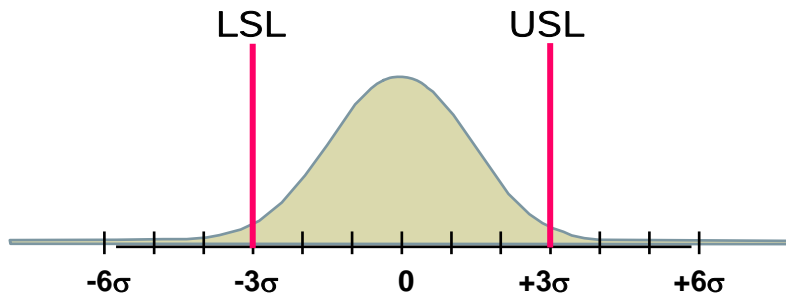
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Six Sigma at Raytheon

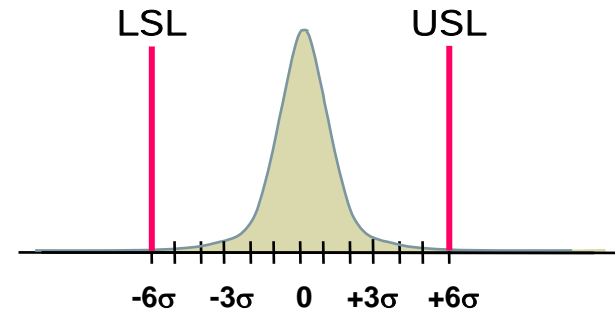
Sigma Quality Level:

The Higher the Sigma level, the Better the Quality

Three Sigma Process



Six Sigma Process



LSL: Lower Specification Limit
 USL: Upper Specification Limit
 σ : 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%
8.1 Million wrong drug prescriptions a year worldwide	10,000 wrong drug prescriptions a year worldwide
Over 11,000 newborn babies accidentally dropped by nurses or doctors in USA each year	Thirteen newborn babies accidentally dropped by nurses or doctors in USA each year
Six short or long landings at Atlanta International Airport each day	Three short or long landings at Atlanta International Airport in a year
Almost 500 incorrect surgical operations each week	One incorrect surgical operation every two weeks

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

- 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

- 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

- 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

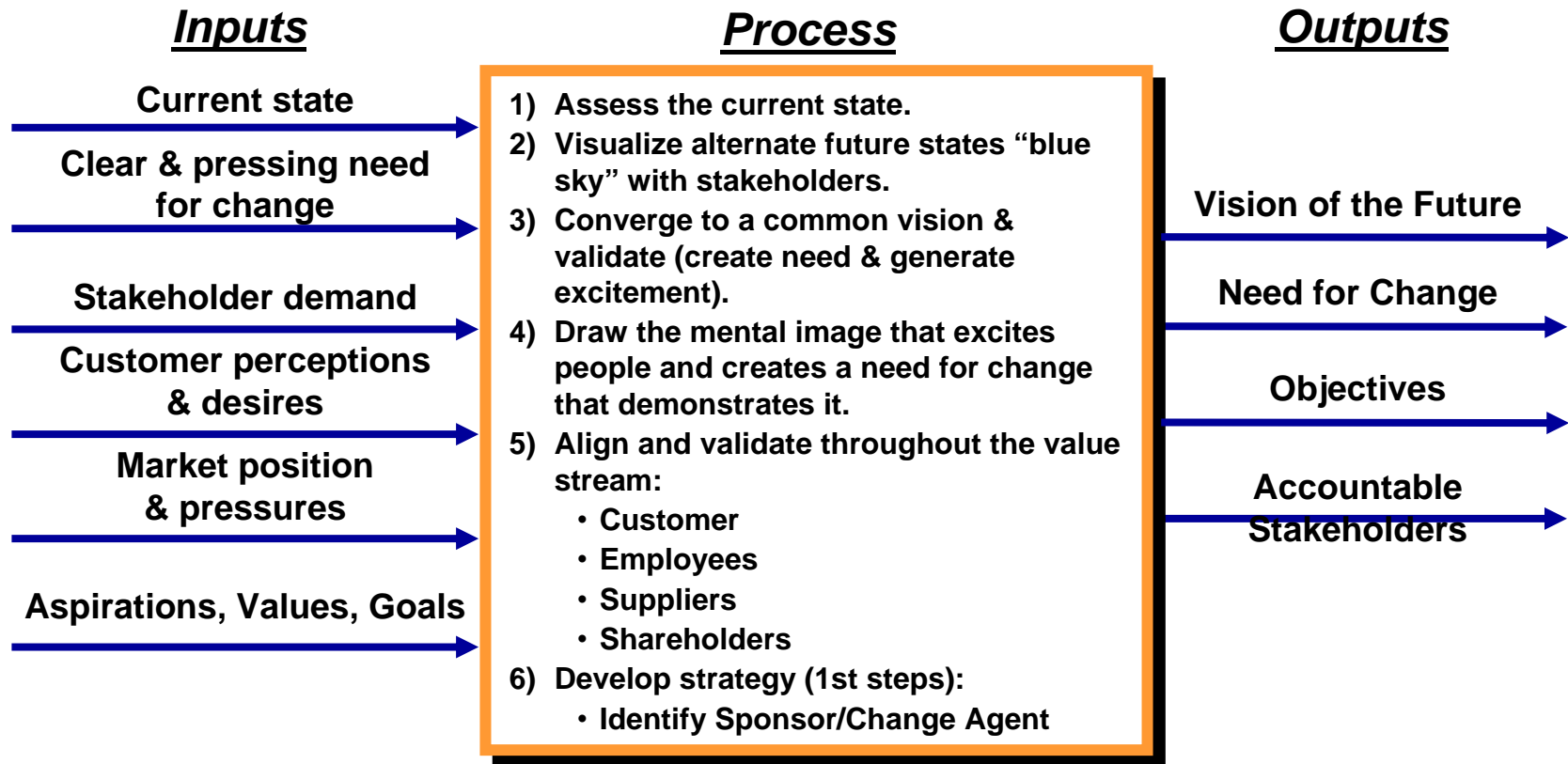
– Establish the Burning Platform

- 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



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Vision = Focus



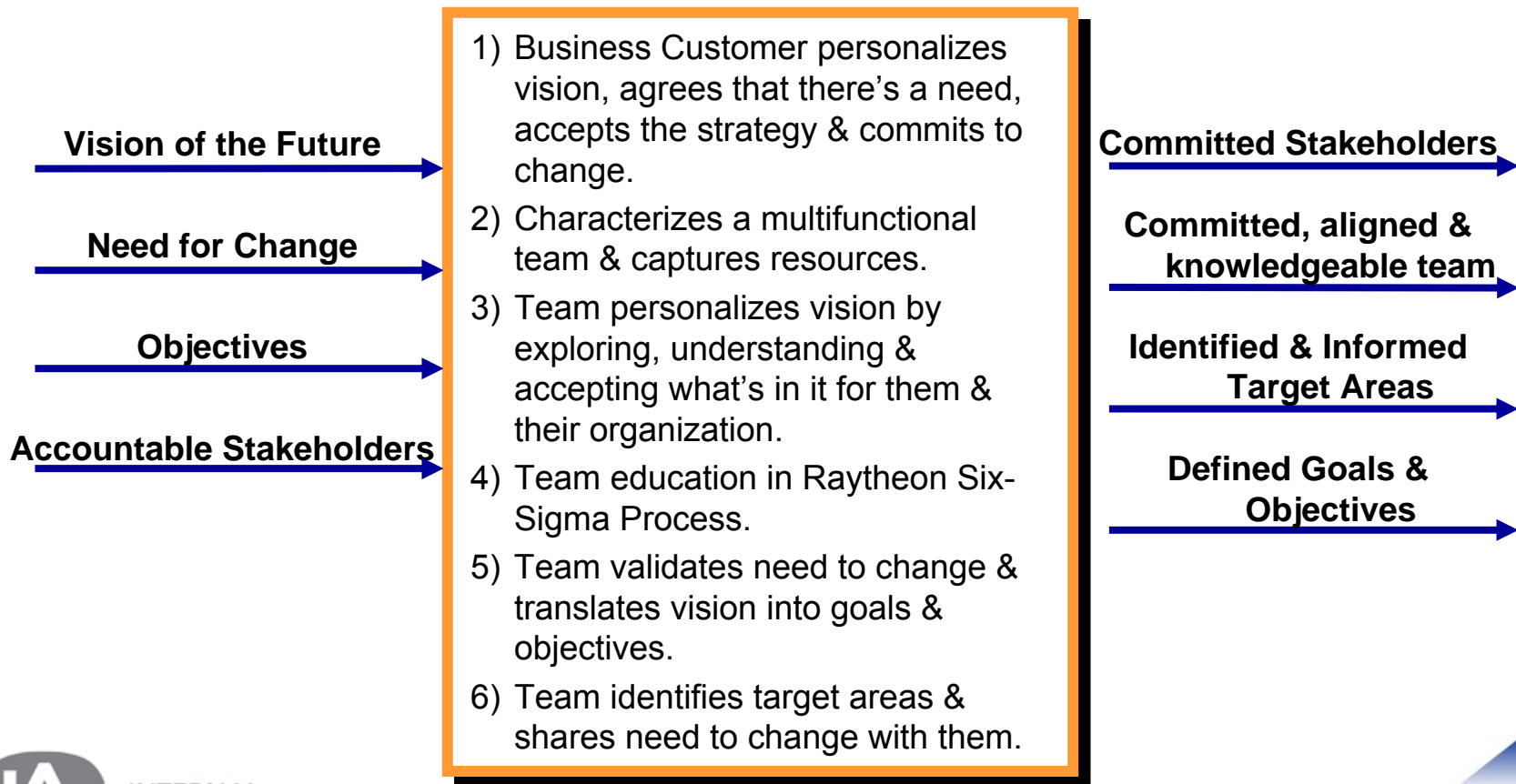
Audit Process – Commit/Audit Planning

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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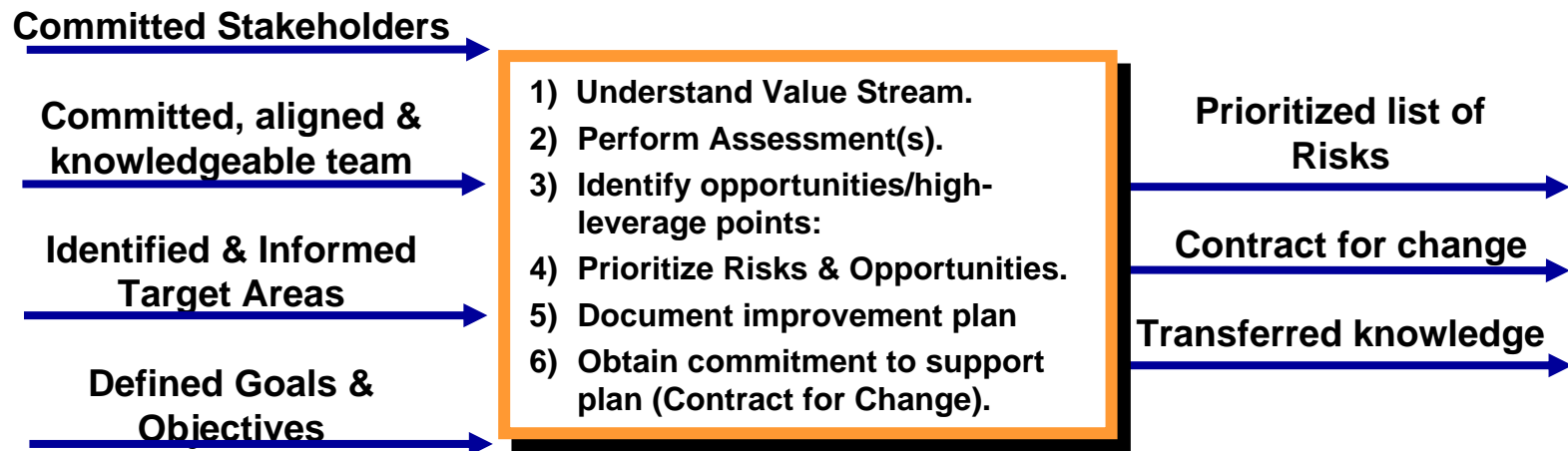
Commitment = Success

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.

Some audit departments may make recommendations at this point.

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

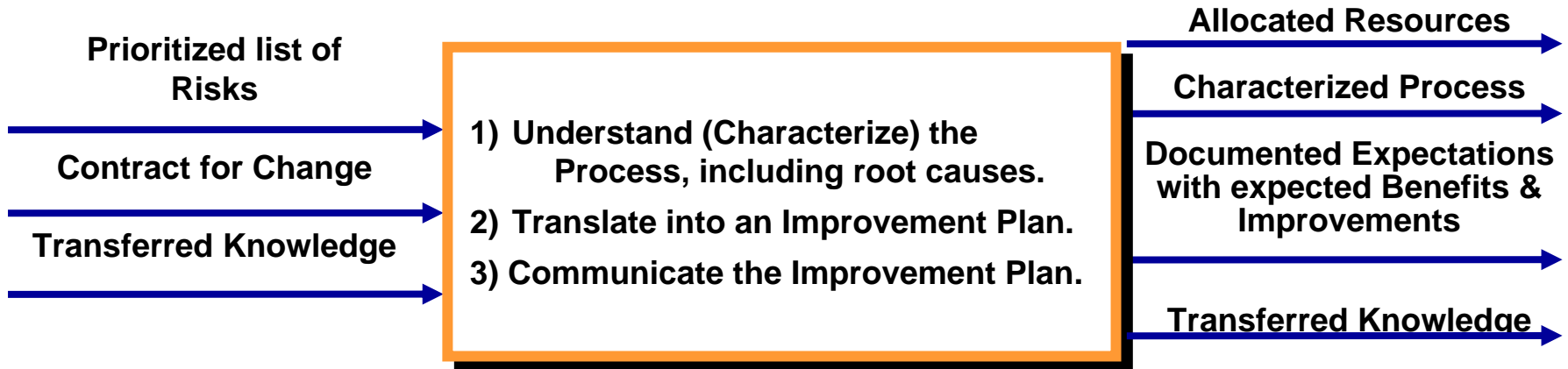
Audit Process – Characterize/Fieldwork

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**

■ Characterize

– Data Collection and Analysis:

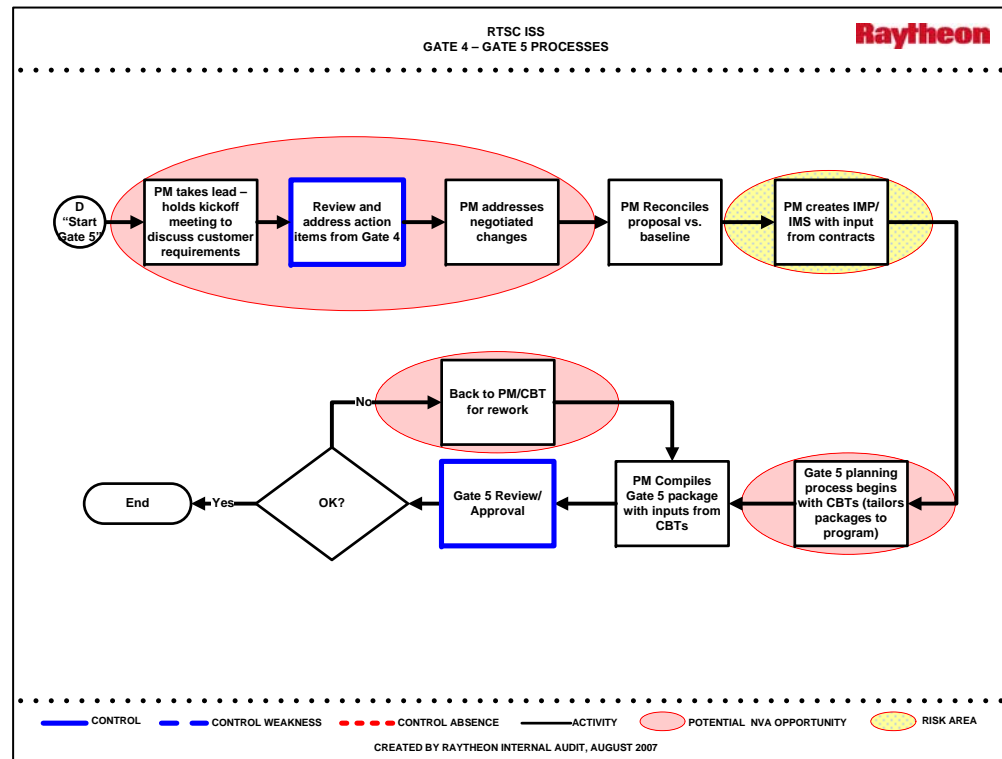
- Identify best practices, Opportunities and Risks
- Define root causes
- What do observations imply regarding Raytheon Customer value stream (waste / variation)?
- Identify improvement alternatives

Audit Process – Characterize/Fieldwork Cont.

■ Characterize

– Example: document/validate process

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



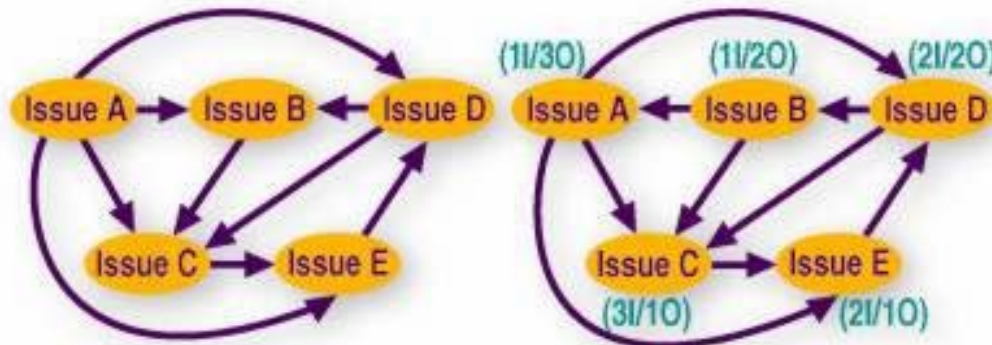
Audit Process – Characterize/Fieldwork Cont.

■ Characterize

– Example: Determining Causal Relationships

□ Interrelationship Diagram

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



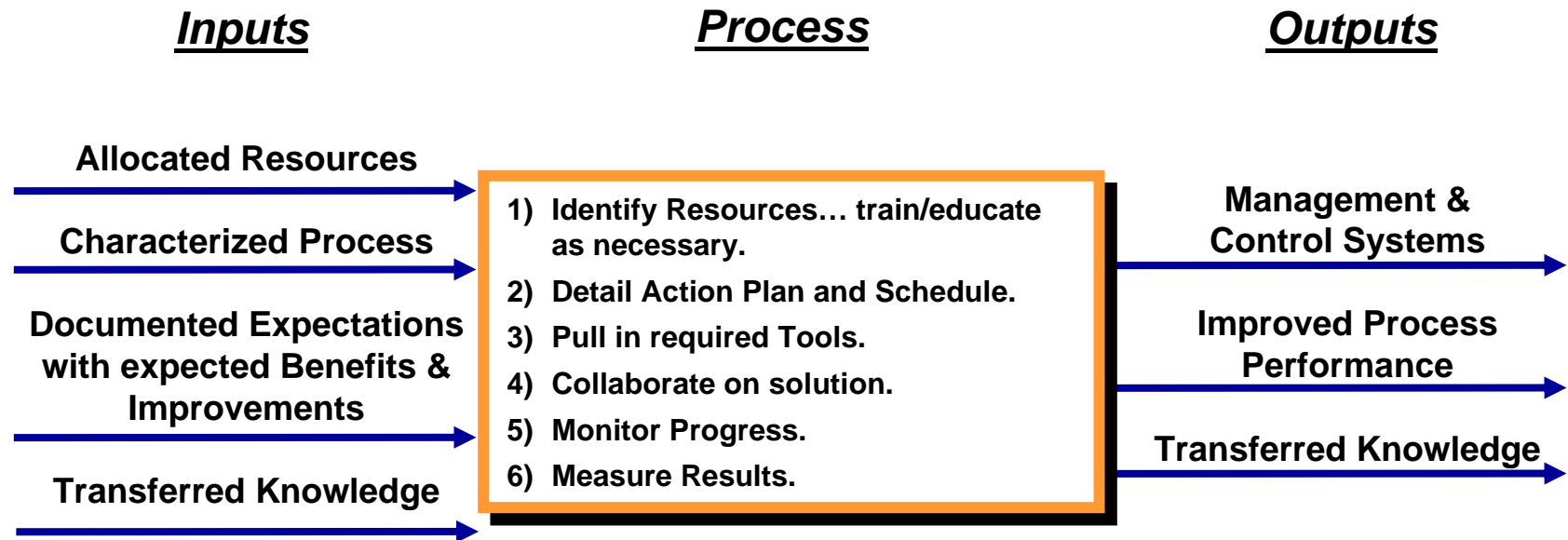
■ Characterize

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

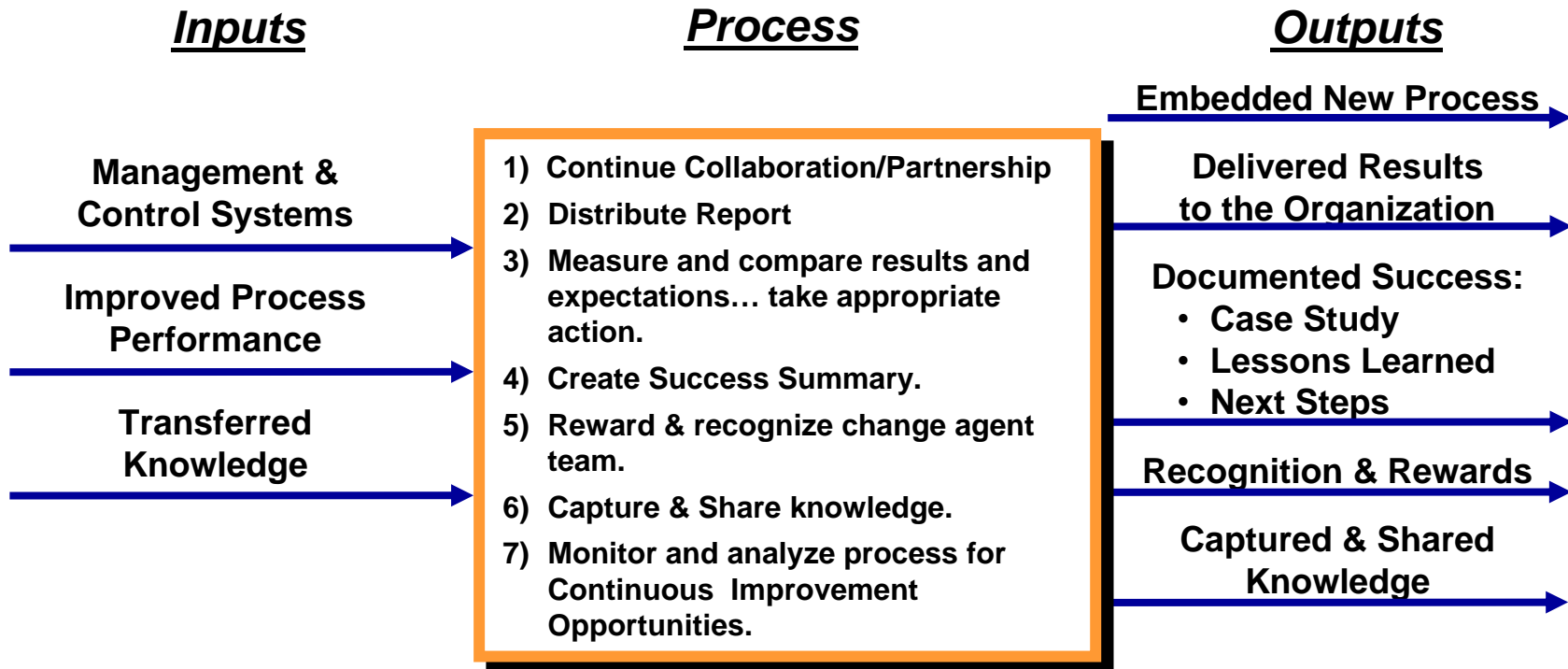
**Tools: Force Field Analysis,
Facilitation,**

– 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

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



Q&A



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