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)
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
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.
Six Sigma at Raytheon

Sigma Quality Level:

The **Higher** the Sigma level, the **Better** the Quality

**Three Sigma Process**

![Three Sigma Process Diagram]

**Six Sigma Process**

![Six Sigma Process Diagram]

- **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!**
### Six Sigma at Raytheon

#### 3 Sigma Process vs. 6 Sigma Process

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

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)
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

- It’s 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

**Inputs**
- Current state
- Clear & pressing need for change
- Stakeholder demand
- Customer perceptions & desires
- Market position & pressures
- Aspirations, Values, Goals

**Process**
1) Assess the current state.
2) Visualize alternate future states “blue sky” with stakeholders.
3) Converge to a common vision & validate (create need & generate excitement).
4) Draw the mental image that excites people and creates a need for change that demonstrates it.
5) Align and validate throughout the value stream:
   - Customer
   - Employees
   - Suppliers
   - Shareholders
6) Develop strategy (1st steps):
   - Identify Sponsor/Change Agent

**Outputs**
- Vision of the Future
- Need for Change
- Objectives
- Accountable Stakeholders
Audit Process – Visualize/Audit Planning Cont.

- **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**
- Vision of the Future
- Need for Change
- Objectives
- Accountable Stakeholders

**Process**
1) Business Customer personalizes vision, agrees that there’s a need, accepts the strategy & commits to change.
2) Characterizes a multifunctional team & captures resources.
3) Team personalizes vision by exploring, understanding & accepting what’s in it for them & their organization.
4) Team education in Raytheon Six-Sigma Process.
5) Team validates need to change & translates vision into goals & objectives.
6) Team identifies target areas & shares need to change with them.

**Outputs**
- Committed Stakeholders
  - Committed, aligned & knowledgeable team
- Identified & Informed Target Areas
- Defined Goals & Objectives
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

Commitment = Success
Audit Process – Prioritize/Planning/Fieldwork

**IPO - Prioritize**

"Determine Improvement Priorities"

**Inputs**
- Committed Stakeholders
- Committed, aligned & knowledgeable team
- Identified & Informed Target Areas
- Defined Goals & Objectives

**Process**
1) Understand Value Stream.
2) Perform Assessment(s).
3) Identify opportunities/high-leverage points:
4) Prioritize Risks & Opportunities.
5) Document improvement plan
6) Obtain commitment to support plan (Contract for Change).

**Outputs**
- Prioritized list of Risks
- Contract for change
- Transferred knowledge
Audit Process – Prioritize/Planning/Fieldwork Cont.

- **Prioritize**

  - 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

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

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
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**
- Prioritized list of Risks
- Contract for Change
- Transferred Knowledge

**Process**
1) Understand (Characterize) the Process, including root causes.
2) Translate into an Improvement Plan.
3) Communicate the Improvement Plan.

**Outputs**
- Allocated Resources
- Characterized Process
- Documented Expectations with expected Benefits & Improvements
- Transferred Knowledge
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
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.
Audit Process – Characterize/Fieldwork Cont.

- **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

**Inputs**

- Allocated Resources
- Characterized Process
- Documented Expectations with expected Benefits & Improvements
- Transferred Knowledge

**Process**

1) Identify Resources… train/educate as necessary.
2) Detail Action Plan and Schedule.
3) Pull in required Tools.
4) Collaborate on solution.
5) Monitor Progress.
6) Measure Results.

**Outputs**

- Management & Control Systems
- Improved Process Performance
- Transferred Knowledge

1) Identify Resources… train/educate as necessary.
2) Detail Action Plan and Schedule.
3) Pull in required Tools.
4) Collaborate on solution.
5) Monitor Progress.
6) Measure Results.
Audit Process – Improve/Fieldwork/Reporting Cont.

- **Improve**
  - 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

**Tools:** Force Field Analysis, Facilitation,
Audit Process – Achieve/Reporting

**Achieve – IPO**

**Inputs**
- Management & Control Systems
- Improved Process Performance
- Transferred Knowledge

**Process**
1) Continue Collaboration/Partnership
2) Distribute Report
3) Measure and compare results and expectations… take appropriate action.
4) Create Success Summary.
5) Reward & recognize change agent team.
6) Capture & Share knowledge.
7) Monitor and analyze process for Continuous Improvement Opportunities.

**Outputs**
- Embedded New Process
- Delivered Results to the Organization
- Documented Success:
  - Case Study
  - Lessons Learned
  - Next Steps
- Recognition & Rewards
- Captured & Shared Knowledge
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 turnover 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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