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Integrating CMMI® and Six Sigma in Software and Systems Engineering

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Agenda

IS&S Training

Lean Thinking

Technology Change Management Working Group – a Case Study

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LMC IS&S Training & Implementation

Executive Lean Training

- Top Executives – one week off site
- Must understand and promote

Green Belt Training

- One week course (corporate initiated/ unit led)
- Certification (completion of course, 1 event, Black Belt Mentor)
- Considering expanding Green Belt training to keep Black Belt training at three weeks

Black Belt Training

- Three week DFSS/Lean course (corporate initiated)
- Certification (completion of course, 3 events, mentored one greenbelt to certification)

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LMC IS&S Training & Implementation

Lean Event Training

- 2-hour training session opens each lean event
- covers tools and methodologies
- geared for those without previous experience

Organizational Training Goals

- green belts to be trained set annually
- black belts to be trained set annually
- $$$ challenge based on process changes
  - Functional/ business/ project

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LMC IS&S Implementation

IS&S Program Process Standard (PPS)

- minimum mandatory set of development processes
- updated using industry standards in which certifications were desired

Example: Quantitative Management

- Key elements
  - program process standards
  - metrics program
- Map to CMMI Organizational Process Performance (OPP)
  - SG1: Establish performance baselines and models
- Map to ISO 9001 – 2001
  - 5.1 Management Commitment
  - 5.4.1 Quality Objectives….
- and so on

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LMC IS&S Process Standard Roadmap

CMMI SE/SW V1.1 – 2002	M&DS PPS - 2002	ISO 9001 - 2000	EIA-632-1999	ISO/IEC 12207 - 1995
Organizational Process Focus (OPF): SG1:Determine Process Improvement Opportunities SG2: Plan and Implement Process Improvement Activities	GEN MPS 0002_[illegible] Program Process S[illegible]rd: 1.1 Quality A[illegible]s [illegible]2.6 Quality [illegible]0002[illegible]	8.1General 8.2 Monitoring and measurement	4.5.3 System Verification Process R32: Enabling Product Readiness	7.3 Improvement process
Organizational Process Definition (OPD): SG1: Establish Organizational Process Assets	G[illegible] GE[illegible] Pr[illegible]	[illegible] General Requirements [illegible]2 Documentation requirements	[illegible]2.1 Plannin[illegible]ss [illegible]Proce[illegible]	5.3.1 Process implementation 7.3 Improvement process
Organizational Training (OT): SG1: Establish Organiza[illegible]onal training Capability SG2: Provide Necessa[illegible] Training	[illegible]	[illegible]etence, awareness & trai[illegible]	[illegible]	5.2.4 Planning 5.2.5 Execution & control 7.4 Training process
Orga[illegible]izational Pro[illegible]erformance (OP[illegible] SG[illegible]tablish P[illegible]ce Baselines and [illegible]ls	[illegible] MPE 00[illegible]	[illegible]gement Commitment [illegible]y objectives [illegible]& measurement of [illegible]ocesses [illegible].4 Monitoring & measurement of [illegible]duct [illegible]Analysis of data [illegible] Continual improvement	5.2 Pr[illegible] 5.3 E[illegible] 5.4 I[illegible]ence[illegible]r En[illegible]Projects	6.8 Problem resolution process 7.3 Improvement process
[illegible]	GEN M[illegible]re[illegible]uous Proces[illegible]ove[illegible] GEN M[illegible]-0022 [illegible]ology Mana[illegible]ment 1.1 The Program P[illegible] Standard[illegible] Quality Activi[illegible] 2.6 Quality	[illegible] Review output [illegible]nalysis of data 8[illegible] Continual Improvement	5.1 Enterprise Factors 5.2 Project Factors 5.3 External Factors 5.4 Influence of other Enterprise Projects	[illegible]rov[illegible]
[illegible]nt [illegible]n	[illegible]3 Program Plan P[illegible]ess 2.3 Contract Mana[illegible]ent 1.1 The Program Pr[illegible]ess Standards: Quality Activit[illegible]s 2.6 Quality	7[illegible] Prov[illegible] 7.5.[illegible] Pro[illegible]ce [illegible] 8.5[illegible] Contin[illegible]prove[illegible]	4.1.1 Supply Process R1: Product Supply [illegible]ning Process [illegible]: Process Implementation Strategy R5: Technical Effort Definition R6: Schedule & Organization [illegible] Technical Plans [illegible]k Directives	5.5.1[illegible] 6.1 [illegible] 6.2 [illegible]g[illegible]s 6.3 [illegible]ity [illegible]ce p[illegible] 6.6 [illegible]oint rev[illegible]ocess 7.1 Manage[illegible]process 7.2 Infrastru[illegible] process 7.4 Training [illegible]cess

Program Process Standard 2002

CMMI SE/SW v1.1

EIA 632 - 1999

ISO 9001 -2000

ISO/IEC 12207 - 1995

Six Sigma links:
Level 2 Measurement & Analysis PA, Level 4/5 PAs

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Lean Methodology

"An organization working together to make continuous improvements without large capital investment"

Purpose

- brings the right people together to understand the process and make immediate improvements to the process.
- evaluates opportunities to reduce cycle time, cost, inventory and eliminate all waste.

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Lean: Terms & Usage

Kaizen - Make people's jobs easier by taking them apart, studying them, and making improvements.

- "KAI" - take apart and make anew
- "ZEN" - think, make good the actions of others, do good deeds and help others

Kaizen tips (VAL, M&A, QPM, CAR, OPP)

- Get rid of old assumptions.
- Look for ways to make things happen now.
- Say "NO" to the status quo.
- Don't worry about being perfect.
- It doesn't have to cost money.
- If something's wrong, fix it on the spot.
- Ask "WHY" five times to get to the root cause.
- Look for wisdom from many people rather than one.
- Never stop improving.
- Full-time participation of team members.
- Keep all affected employees informed of changes.

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Lean: Kaizen Procedure

Top Mgmt Kick-off of event

Determine Team Objectives and Goals

Lean/Six Sigma Training

Map as-is Process

Identify Waste in the process

Use root cause analysis to evaluate issues

Brainstorm solutions

Evaluate the solutions against the objectives

Report to Sponsor

Implement validated solutions to improve the process

Standardize: Map the to-be / improved process

Report to Sponsor

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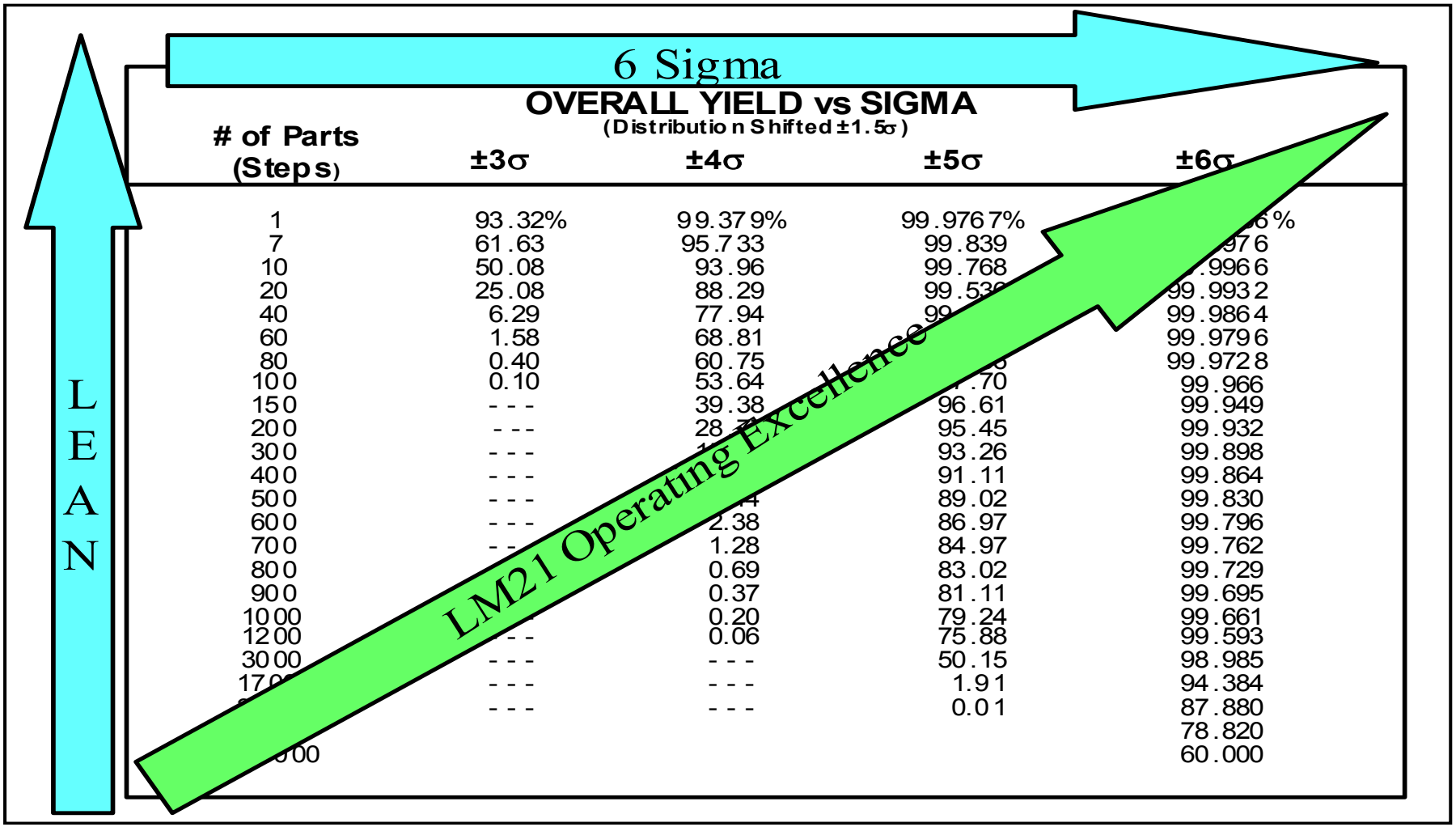
Lean: Six Sigma Representation

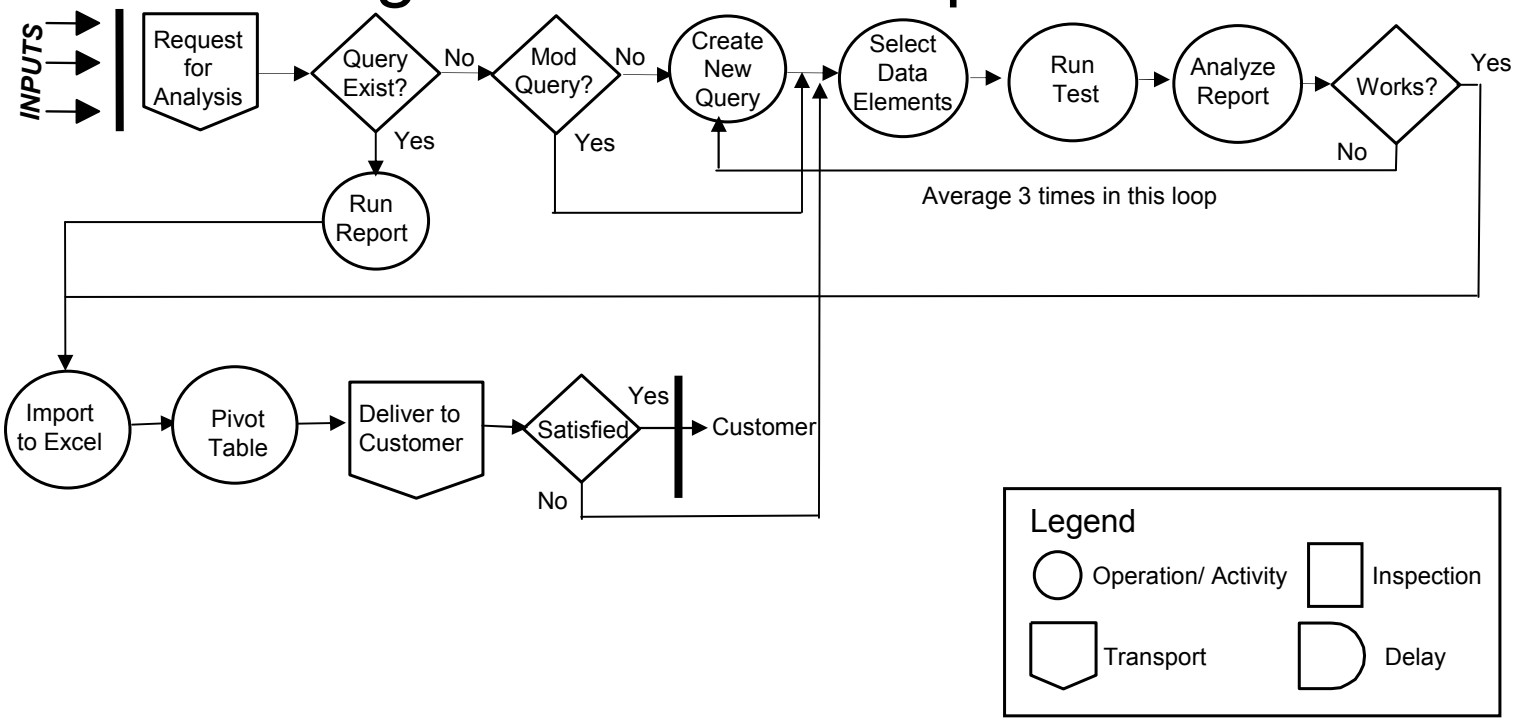


OVERALL YIELD vs SIGMA
(Distribution Shifted ±1.5σ)

# of Parts (Steps)	±3σ	±4σ	±5σ	±6σ
1	93.32%	99.379%	99.9767%	6%
7	61.63	95.733	99.839	976
10	50.08	93.96	99.768	.9966
20	25.08	88.29	99.53	99.9932
40	6.29	77.94	99	99.9864
60	1.58	68.81		99.9796
80	0.40	60.75		99.9728
100	0.10	53.64	.70	99.966
150	- - -	39.38	96.61	99.949
200	- - -	28.	95.45	99.932
300	- - -	1	93.26	99.898
400	- - -		91.11	99.864
500	- - -	4	89.02	99.830
600	- - -	2.38	86.97	99.796
700	- -	1.28	84.97	99.762
800		0.69	83.02	99.729
900		0.37	81.11	99.695
1000		0.20	79.24	99.661
1200	- -	0.06	75.88	99.593
3000	- - -	- - -	50.15	98.985
17	- - -	- - -	1.91	94.384
	- - -	- - -	0.01	87.880
				78.820
00				60.000

Lean: Staffing Analysis Example

"As Is" Logical Process Map



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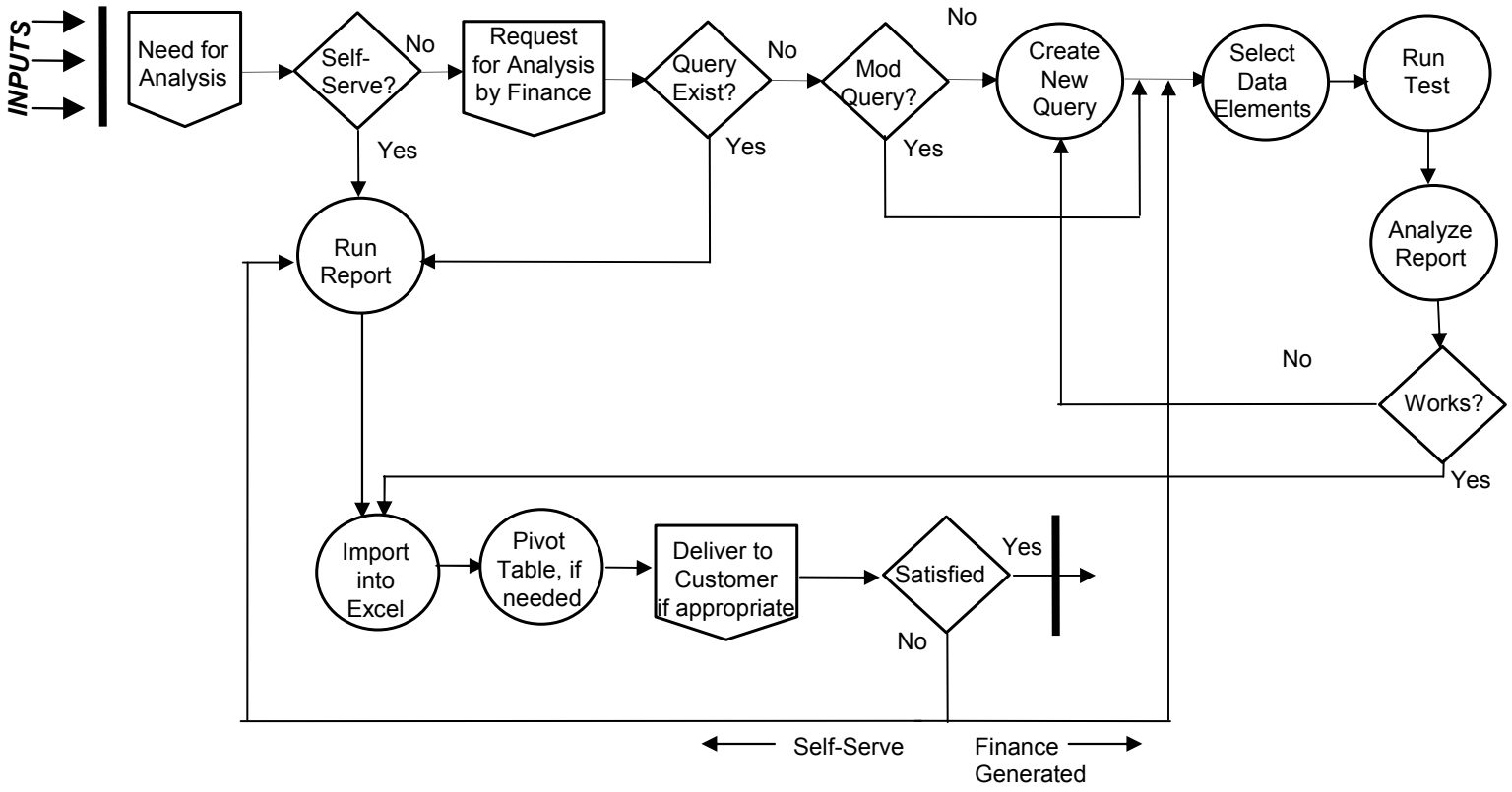
Lean: Staffing Analysis Example

"To be" Logical Process Map



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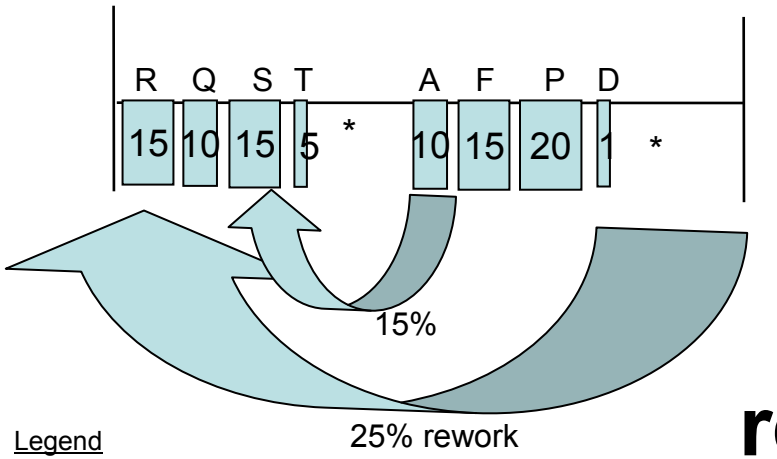
Lean: Staffing Analysis Example

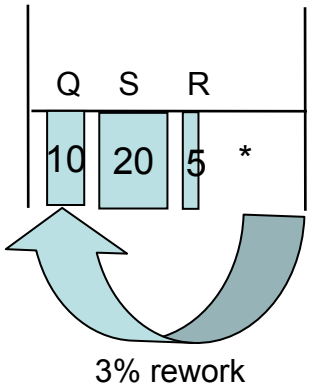
Time Value Map: As Is = 19 hours



Legend
R = Request
Q = Query
S = Select data
T = Test Report
A = Analysis
F = Format
P = Pivot table
D = Deliver
* = Variable wait time

63% reduction in cycle time

Time Value Map: To Be = 7 hours



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LMC IS&S Lessons Learned

Six Sigma is more than statistical analysis

- It is a tool box of methodologies that align with an organization's process improvement.
- The alignment is directly related to high maturity but is not restricted to that.

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LMC IS&S – Strategy

Analyzed Principles

- Value from the customers' perspective
- Value Stream – measured
- Flow
- Pull
- Perfection – rapid feedback / mistake proofing

World-wide Benchmarking Results

- A 4 Sigma company will spend > 10% of revenue on internal and external repair.
- A 6 Sigma company will spend < 1 % of revenue on internal and external repair.

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LMC IS&S Project Selection

1. Process Improvement Recommendation (PIR)
   - any one can submit
   - process suggestion passed to Process Owner to evaluate, determine feasibility, determine level of institutionalization (and determine if pilot is necessary)

2. E-Transformation
   - all business processes that affect overhead are applicable
   - selection based on ROI and relevance to business – firm understanding of the before state
     - Just do it Projects
     - Kaizen event with rollout plan
   - require use of Six Sigma methodologies/ tools to pursue optimization

3. Technology Change Management Working Group (TCMWG)
   - once a year call for ideas – process oriented
   - can also be used to pilot ideas from PIRs
   - selection based on understanding the before state to measure the after state
   - modeling techniques implementing a six sigma target

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LMC IS&S Technology Change Management

Purpose (M&A, RSKM, TS, QPM, OPP, OID)

- identify and assess emerging process-related technologies (e.g., Tools, Commercial Practices)
- guide those having benefit into our development activities in an orderly manner

Implementation (OID)

- Technology Change Management (TCM) Working Group (TCMWG) formed to identify process improvement needs and oversee the planning, progress, and application of solutions
- each functional organization represented on TCMWG
- annual call for TCM project proposals
  - parallel effort with call for Independent Research And Development (IRAD) projects
  - based on needs expressed in the strategic plan
- meets monthly to review ongoing projects, assess new business needs, and communicate new technology

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LMC IS&S Technology Change Management

Definition

- process-centric (as opposed to product-centric)
- separation of former and latter based on legal barriers
- Technology changes for product is accomplished by extensive IRAD effort
- enterprise wide

Focus on TCM motivated by Acquisition Reform in 1995

- considerable maturing of TCM process in six years
- business results rather than just “ticket punching”
- utilizes value added methodology – 6 Sigma Tools

Driven by LMC IS&S Strategic Plan

- TCM participants contribute to Strategic Plan

Harmonious with company-wide process philosophy

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LMC IS&S TCM Summary

The TCM Program is driven by the strategic process needs of our product lines.

TCM projects have had a positive impact on new business pursuits.

TCM projects have resulted in cost savings as well as cost avoidance.

TCM projects can result in changes to the standard processes.

Our business leaders are encouraged to push process boundaries through TCM.

Lean and Six Sigma Activities have resulted in an increase in award fee, increased software productivity, and earlier detection of defects.

Thank You!!!

Questions???