NORTHROP GRUMMAN DEFINING THE FUTURE

Mission Systems

Using Six Sigma to Achieve CMMI Levels 4 and 5

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What is Six Sigma?

- **Six Sigma is a management philosophy based on meeting business objectives by striving for perfection**
  - A disciplined, data-driven methodology for decision making and process improvement
- **Six Sigma consists of several integrated methods:**
  - Process Management
  - Voice of the Customer
  - Change Management
  - Tools for Measuring Variation and Change
  - Business Metrics
- **The focus is on understanding and reducing variation**

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DMAIC Steps

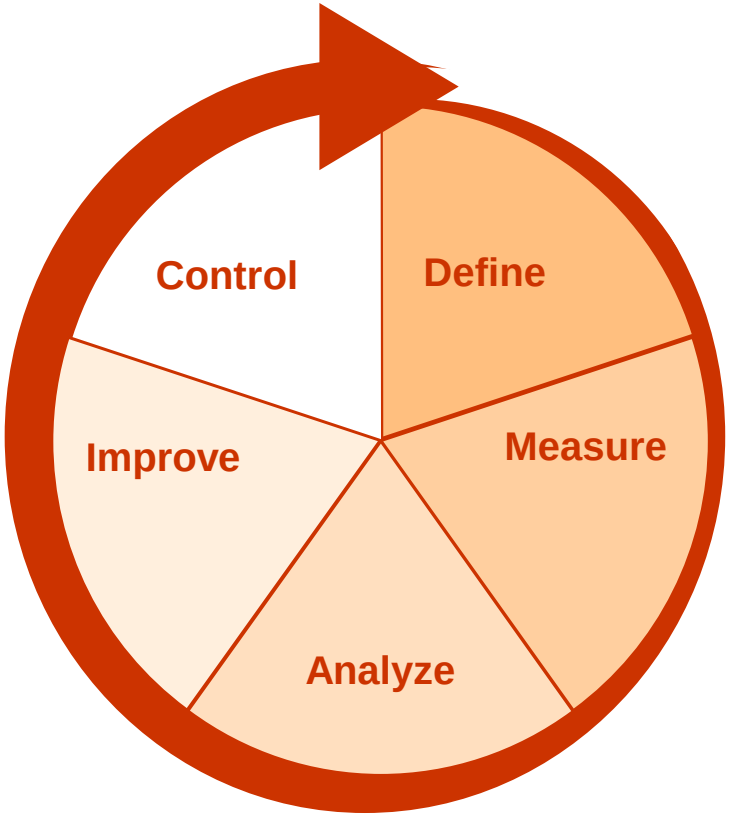
DEFINE
Set project goals and objectives

MEASURE
Narrow range of potential causes and establish baseline capability level

ANALYZE
Evaluate data/information for trends, patterns, causal relationships and "root causes"

IMPROVE
Develop, implement and evaluate solutions targeted at identified root causes

CONTROL
Make sure problem stays fixed and new methods can be further improved over time



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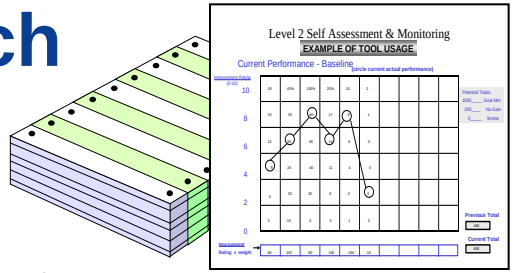
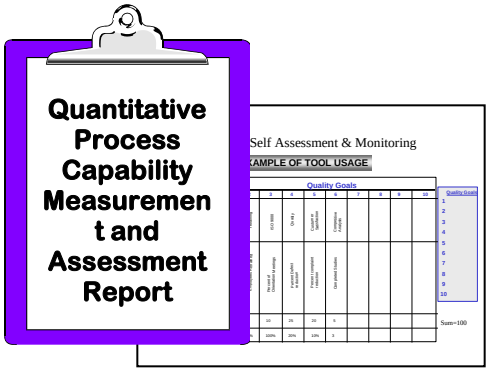
Our Six Sigma Approach





Linked with Business Planning and Oversight

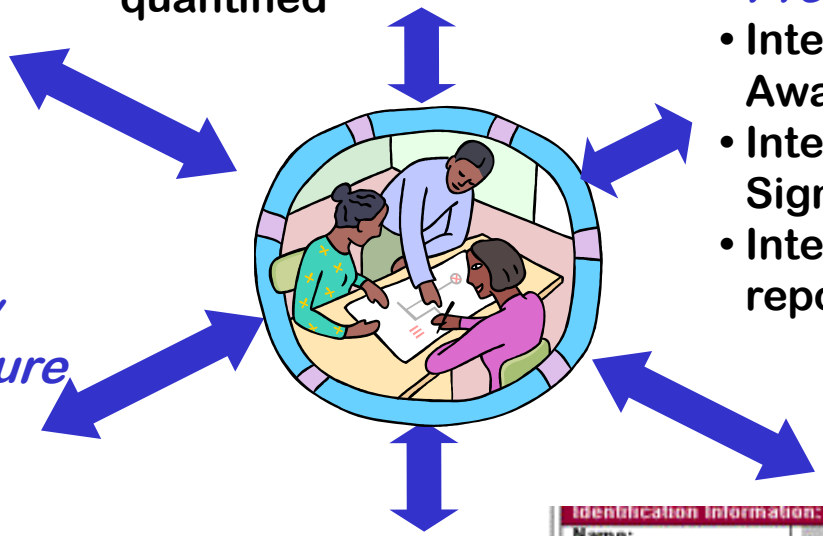
- Business planning
- Project selection

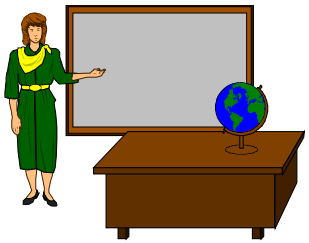
Quantitatively Driven

- Six Sigma improvements are quantified

Integrated with Quality Program

- Integrated Training, Awareness, & Policies
- Integrated CMMI & Six Sigma projects
- Integrated tracking and reporting via DB, PRA, etc.





Enabled by Infrastructure

- Training
- Tools
- Awareness
- Database

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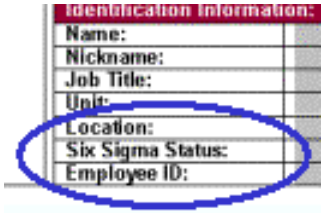
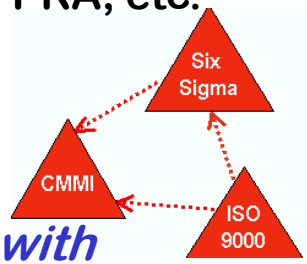
Tied to Employee Performance

- Goals, awards
- Job and career paths





Engaged with External Customers

- Visibility
- Participation

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Six Sigma Implementation

- **Starting implementing Six Sigma in 2001**
- **Trained over 3000 Green Belts (80 hours), and over 200 Black Belts (160 hours)**
- **Completed several hundred projects covering all functional areas**
  - Customer involvement and award fee citations
- **About half of the projects are improving an engineering process**

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Capability Maturity Model Integrated

Level	Focus	Process Areas
5 Optimizing	*Continuous process improvement*	Causal Analysis and Resolution Organizational Innovation and Deployment
4 Quantitatively Managed	*Quantitative management*	Quantitative Project Management Organizational Process Performance
3 Defined	*Process standardization*	Organizational Process Focus Organizational Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis and Resolution Requirements Development Technical Solution Product Integration Verification Validation
2 Managed	*Basic project management*	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management
1 Performed		

Level 5
Focus is on preventing defects and innovation (addressing common causes of variation)

Level 4
Focus is on understanding and managing special causes of variation, at both the project and organizational levels

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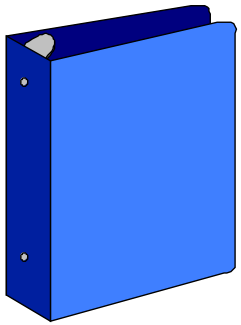
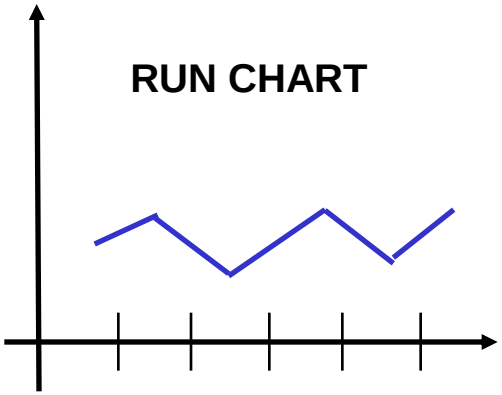
Maturity Level 4

Understanding and managing special causes of variation

Organization

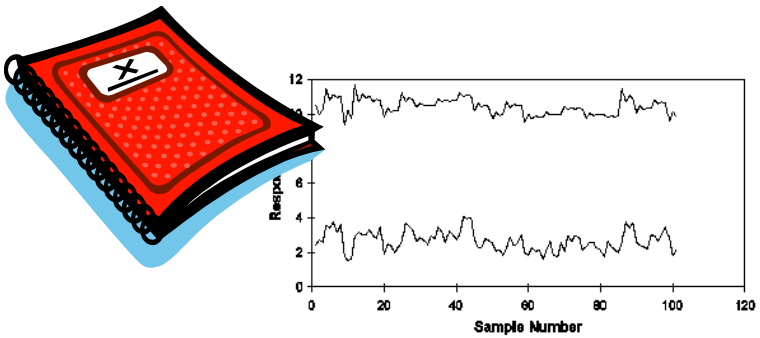
- Establishes organizational goals
- Establishes standard process
- Characterizes process performance and quality of the standard process





Project

- Establishes project goals
- Tailors standard organizational process to create project's defined process
- Selects critical subprocesses to quantitatively manage



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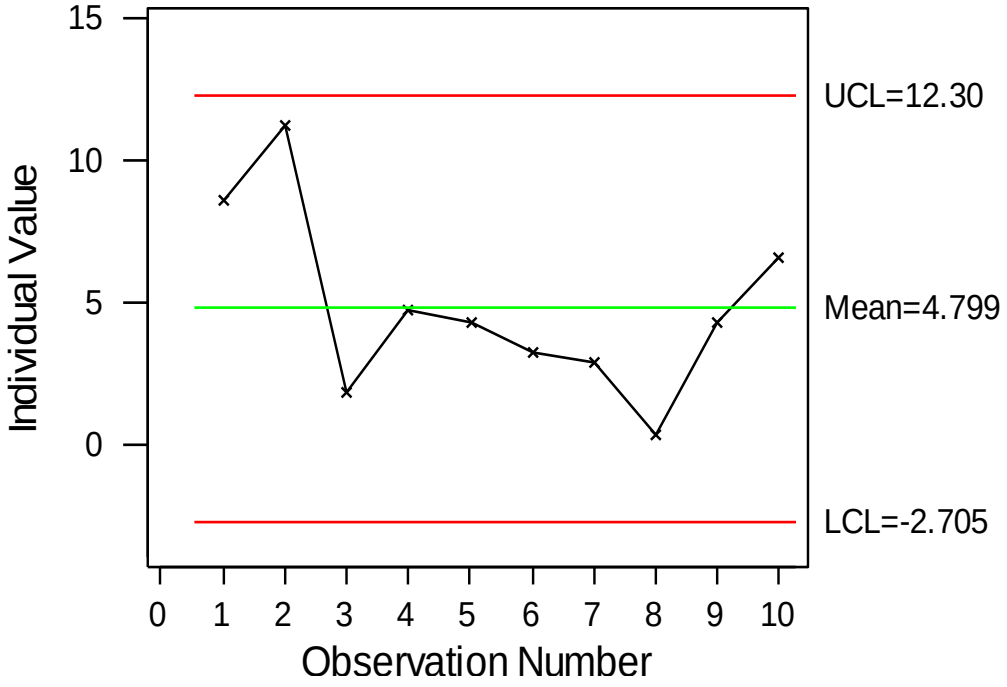
Quantitative Management Example (not real data)

Peer Reviews – Understanding the Process

- **How many errors does the team typically find in reviewing an interface specification?**
- **Useful in evaluating future reviews**
  - Was the review effective?
  - Was the process different?
  - Is the product different?



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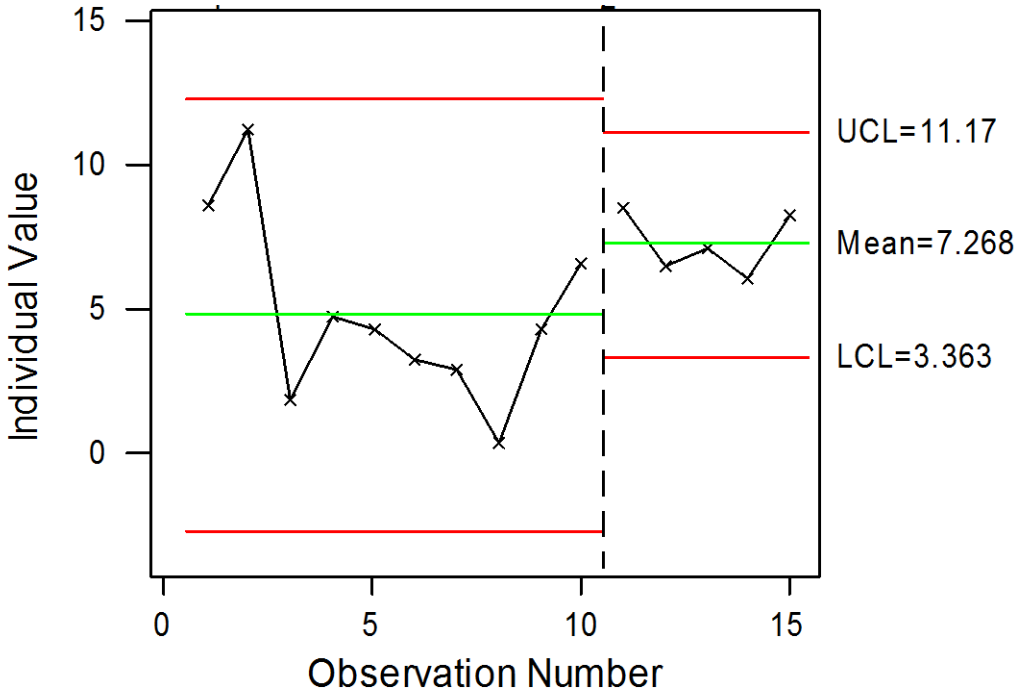
Quantitative Management Example (not real data)

Peer Reviews – Improving the Process

- **Reduce the variation**
  - Train people on the process
  - Create procedures/checklists
  - Strengthen process audits
- **Increase the effectiveness (increase the mean)**
  - Train people
  - Create checklists
  - Reduce waste and re-work
  - Replicate best practices from other projects



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New Questions at Level 4

- Which subprocesses are predictable at the project level? At the organizational level?
- Should different projects control different subprocesses?
- What statistical data should the organization collect?
- What differences in project subprocesses are permissible? How do they impact the historical data?
- Given two projects with two different subprocesses, how do I judge which is better? What does better mean? In what situations would it be better?
- Can I trade cost versus quality? How do I explain this trade to my customer?

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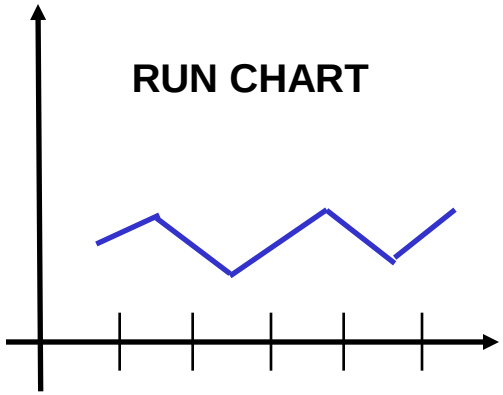
Maturity Level 5

Preventing defects and innovation (addressing common causes of variation)

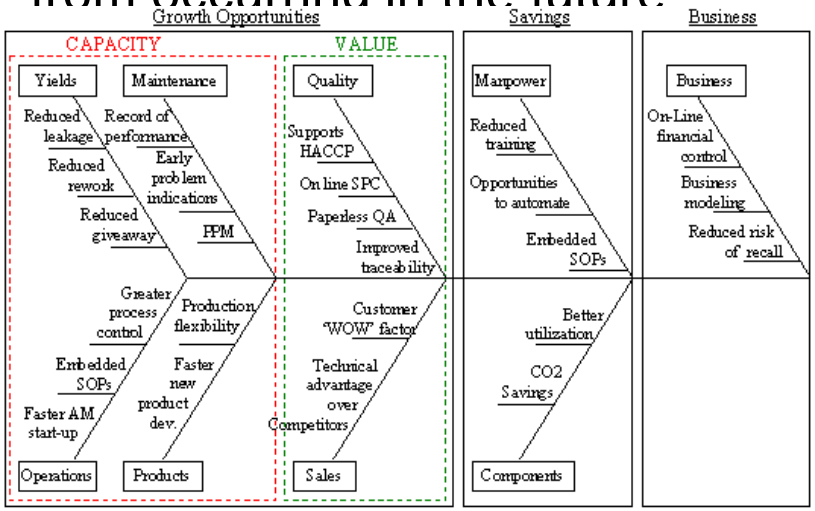
Organization

- Identifies incremental and innovative improvements
- Pilots improvements
- Deploys and measures (quantitatively) the results



Project

- Identifies causes of defects and other problems
- Takes actions to prevent them from occurring in the future



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New Questions at Level 5

- What are reasonable organizational process and quality goals?
- How radically should I change organizational processes to meet these goals? How fast?
- What process changes should I make?
- How do I define a defect?
- Which defects are unrelated to process? How do I eliminate those from the analysis?

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Results

- **Organizational-wide adoption and training of Six Sigma has resulted in a workforce that understands variation**
  - Common language
  - Common toolset
  - Common focus on reducing variation
- **Results have been seen in our rapid achievement of CMMI Levels 4 and 5**
  - 4 of our organizations have now achieved Level 5