NORTHROP GRUMMAN DEFINING THE FUTURE

Mission Systems

Minimizing SCAMPI Costs via Quantitative Methods

CMMI Technology Conference & User Group
17-20 November 2003

Ron Ulrich, Northrop Grumman
ron.ulrich@ngc.com
Rick Hefner, Northrop Grumman
rick.hefner@ngc.com

Copyright 2003 Northrop Grumman Space and Mission Systems Corp. All Rights Reserved.

Agenda

- **Background**
- **Applying Six Sigma**
  - Preparation
  - Evidence Review
  - Interviews
  - Consolidation
- **Measured Success**

Copyright 2003 Northrop Grumman Space and Mission Systems Corp. All Rights Reserved.

NORTHROP GRUMMAN
Mission Systems

Northrop Grumman Mission Systems

- **A leading global integrator of complex systems**
  - Based on information technology and systems engineering expertise
  - Integrated solutions: architecture, development and sustainment
- **$3.9 B Estimated 2003 Sales**
- **15,000+ Employees**
- **Diverse business base**
  - Presence in over 20 countries, 50 states
  - 2,000 active contracts and task orders
- **Near-term goal to achieve CMMI Level 5 at all sites**

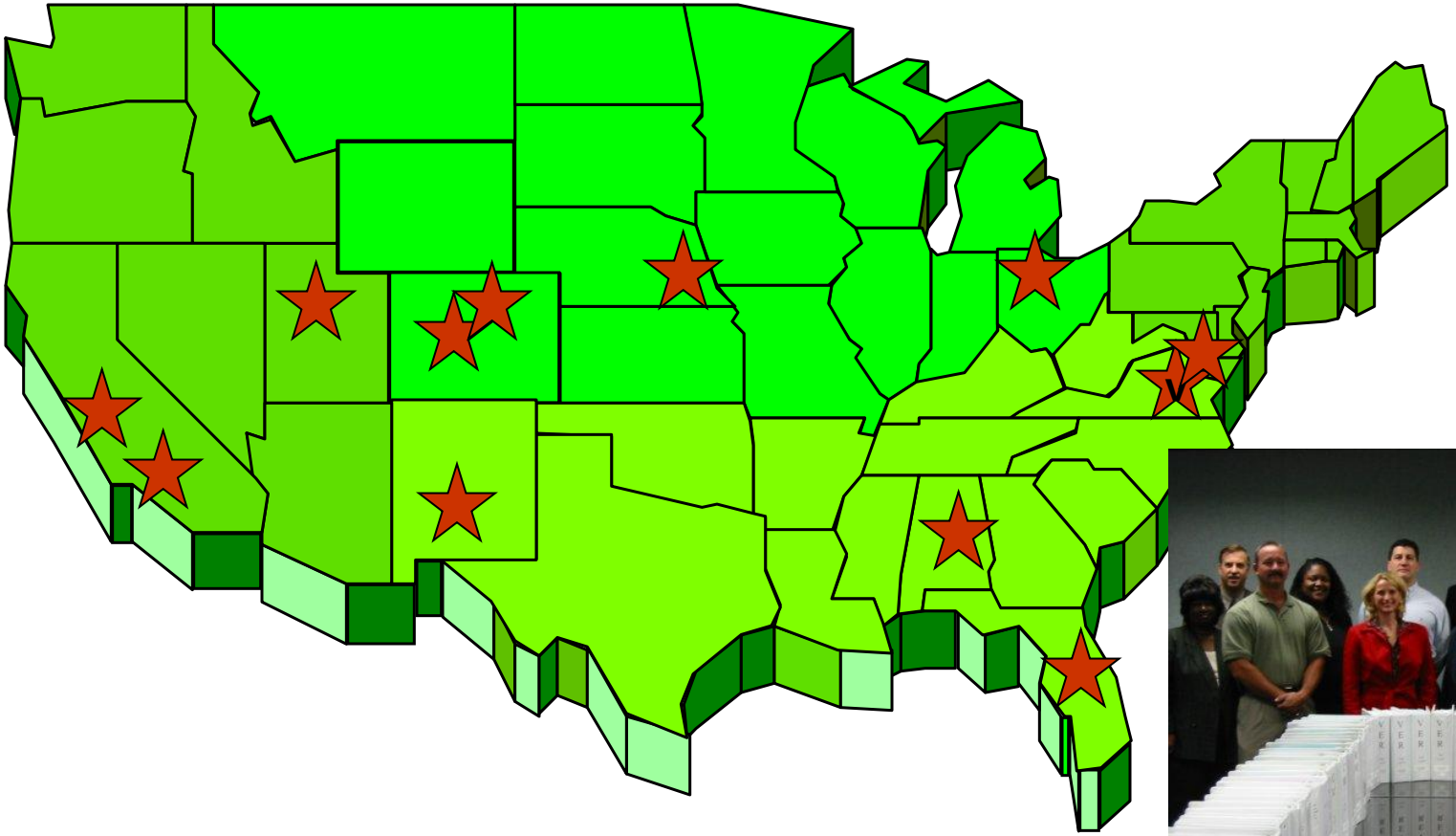
Treasury Communications System

Intercontinental Ballistic Missile Program

Guardrail

Copyright 2003 Northrop Grumman Space and Mission Systems Corp. All Rights Reserved.

Many Sites – Many Appraisals



Lots of opportunity for savings!

Copyright 2003 Northrop Grumman Space and Mission Systems Corp. All Rights Reserved.

Applying the Six Sigma DMAIC Process

DEFINE	MEASURE	ANALYZE	IMPROVE	CONTROL
Charter team, map process & specify CTQs	Measure process performance	Identify & quantify root causes	Select, design & implement solution	Institutionalize improvement, ongoing control

- **A Six Sigma project was launched to optimize the SCAMPI appraisal process**
  - Minimize the costs; maximize the accuracy
- **Key considerations:**
  - Project preparation time
  - On-site appraisal time
  - Cost & resources
  - Accuracy of appraisal results

Copyright 2003 Northrop Grumman Space and Mission Systems Corp. All Rights Reserved.

Mapping the Process to Identify Bottlenecks

Suppliers	Inputs	Process	Outputs	Customers
Organizations	Assessment Schedules	**Improve SCAMPI Appraisals**	Improvement Plan	Projects
Project Personnel	Project Evidence		Savings	Appraisal Teams
Lead Appraisers	Personnel Availability		Effective Appraisals	Organizations
	Project Schedules			Lead Appraisers

Process Steps

Site/Project Readiness → Team Training → Evidence Review → Interviews → Consolidation → Findings

Copyright 2003 Northrop Grumman Space and Mission Systems Corp. All Rights Reserved.

As-Is Process

Lead Appraiser
Assembles/trains team, reviews readiness

Appraisal Team

Programs
Assemble evidence

Review evidence

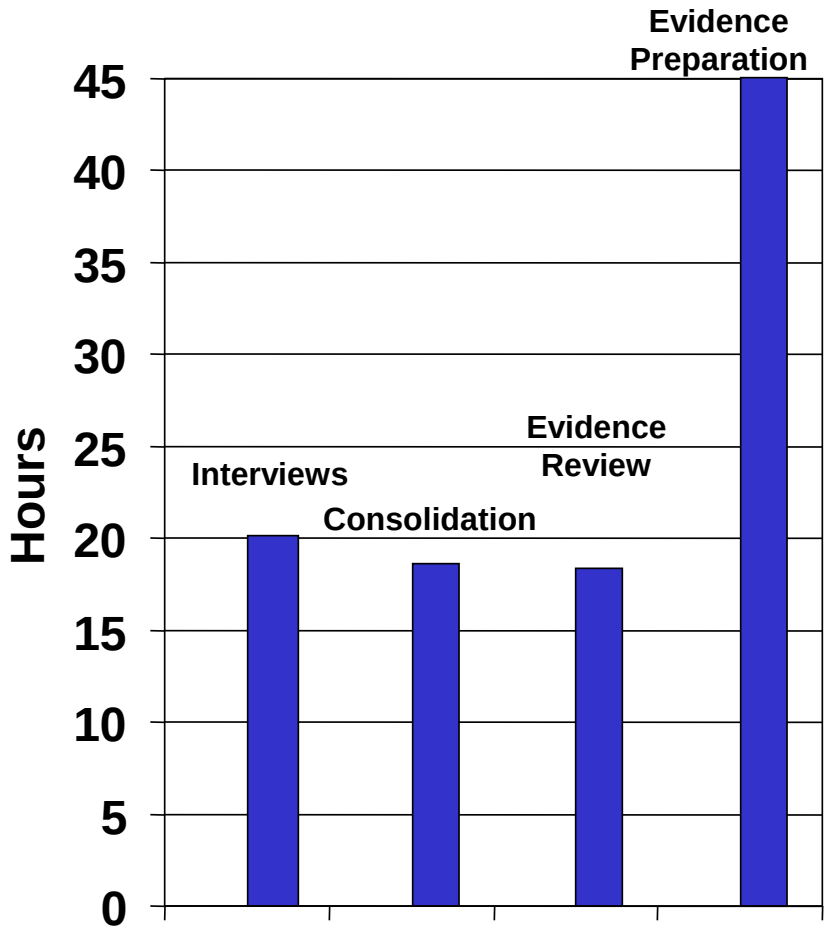
Conduct interviews

Consolidate data

Present findings

Copyright 2003 Northrop Grumman Space and Mission Systems Corp. All Rights Reserved.

Quantitative Management and Causal Analysis



- Collected metrics on time spent on various appraisal activities, defects
- Used Pareto chart to identify bottlenecks, opportunities for improvement
- Used individuals charts to study variation in the appraisal process
- Used fishbone charts and other causal analysis methods to identify potential improvements

Copyright 2003 Northrop Grumman Space & Mission Systems Corp.

NORTHROP GRUMMAN
Mission Systems

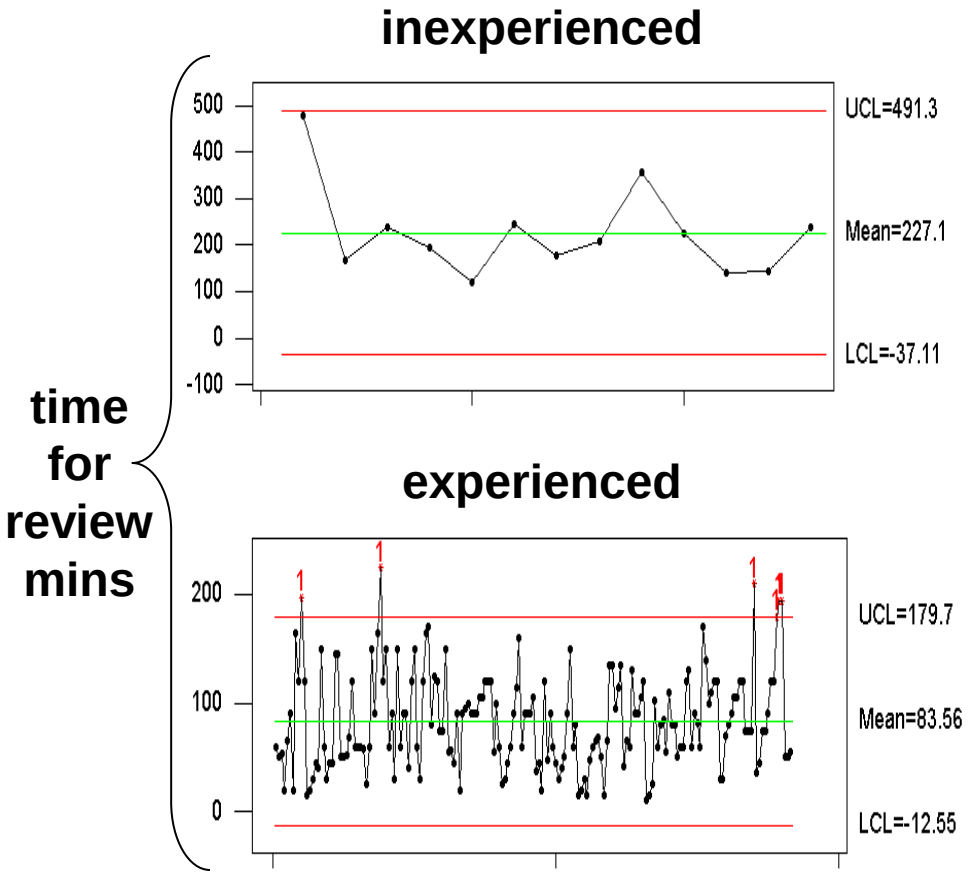
Reducing Appraisal Time by Better Preparation

Date:	1-Oct-03				© 2003 Northrop Grumman Space and Mission Systems	Software POCs	Last Name	First	Phone Number			Systems PC		
Project:					SAT Version 4.3e	Project Manager:						Project M		
Division:	Select a Division				CMMI_SAT_2K_V4_3e.xls	Project SAT POC:						Project SA		
Tool Controls	Levels	○ Level 2	○ Level 3	○ Level 4	○ Level 5	LOE ◉ Hide ○ Show	Software Engineering							
	Scope	◉ All	○ Plan	○ No Plan	○ My Ans'r Area	ORG ◉ Lock ○ Unlock								
CMMI & ISO Ref	Export	Maturity Level			Import	Typical Evidence	Baseline Status	Current Status	Actual Evidence	Implementation Plan	Implementation Actual	Remarks	Baseline Status	Cu S
Level 2 – Managed							Level 2 – Managed							
Requirements Management							Requirements Management							
	SG 1	G	Requirements are managed and inconsistencies with project plans and work products are identified.											
ReqM	SP 1.1	P	Does the project develop an understanding with the requirements providers on the meaning of the requirements?	meeting records, review records, an agreed to set of written requirements			No	No					No	
ReqM	SP 1.2	P	Does the project obtain commitment to the requirements from the project participants?	sign off			No	No					No	
ReqM	SP 1.3	P	Does the project manage changes to the requirements as they evolve during the project?	CM records, change requests, CCB records, sign off			No							
ReqM	SP 1.4	P	Does the project establish and maintain bi-directional traceability between the requirements and the project plans and work products?	requirements traceability matrix, requirements tracking system, test verification matrix			No							
ReqM	SP 1.5	P	Does the project identify inconsistencies between the project plans and work products and the requirements?	revision histories, change requests			No							
	GG 2	G	The process is institutionalized as a managed process.											
ReqM	GP 2.1a (CO 1)	S	Does the organization establish and maintain a policy for planning and performing the requirements management process?	organizational policy (e.g., Systems PRM 931 Requirements Development and Management)			No							
ReqM	GP 2.2 (AB 1)	P	Does the project establish and maintain the plan for performing the requirements management process?	project plans			No							

- **Most appraisal time is spent mapping evidence to CMMI practices**
- **A Self-Assessment Tool was created to organize the mapping**
  - Serves as the PIID
- **Can generate compliance statistics across any level of the organization**
- **Used to generate evidence review and interview worksheets for the appraisal team**

Copyright 2003 Northrop Grumman Space and Mission Systems Corp. All Rights Reserved.

Characterizing Evidence Review Time



- **The time is takes to review evidence is predictable**
  - Some variation by process area
- **The mean review time and variation is much higher among inexperienced appraisers**
  - At least half of the appraisers on the team should be experienced
- **Review time is driven by the clarity with which evidence is assembled and mapped to the CMMI practices**
  - Ensure thorough evidence scrub prior to on-site period
  - Bad evidence (“defects”) causes unexpected schedule overruns

Copyright 2003 Northrop Grumman Space and Mission Systems Corp. All Rights Reserved.

Reducing Interview Costs

- **To reduce cost:**
  - Used pre-scripted interview questions
  - Conducted interviews simultaneously in mini-teams
  - Scheduled one interview per practice & instantiation (no SCAMPI requirement for multiple interview sources like in CBA IPI)
- **Maintain appraisal accuracy by emphasis on direct evidence**
  - Interviews simply confirm that the evidence is “real”
  - Interviews are <u>not</u> a test of how well someone remembers the practice

Copyright 2003 Northrop Grumman Space and Mission Systems Corp. All Rights Reserved.

Reducing Consolidation Time

Crafting observations

- **Voice of Customer data indicates organizations and projects simply want to know which practices they do not comply with**
  - Consistent with Verification mode
  - No need to wordsmith charts
- **Created an Appraisal Findings tool to capture the ratings at the instantiation level (every project, every practice)**
  - Simplifies data consolidation, team discussion

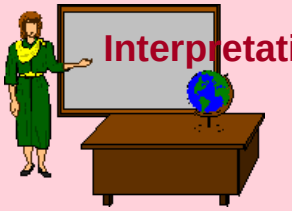
Reviewing as a team

- **Most of the time is spent arguing about how to interpret a few CMMI practices**
  - Especially Generic Practices
- **Created "CMMI Interpretation" training which clarifies how ambiguous practices will be evaluated**
  - Driven by areas where disagreement occurred
  - Useful in reaching team (and organizational) consensus

Copyright 2003 Northrop Grumman Space and Mission Systems Corp. All Rights Reserved.

Should-Be Process

Lead Appraiser
Assembles/trains team, reviews readiness



Interpretations Training

Appraisal Team

Programs
Assemble evidence

Review evidence

Conduct interviews

Consolidate data

Present findings

Self-Assessment Tool

Appraisal Findings Tool

Copyright 2003 Northrop Grumman Space and Mission Systems Corp. All Rights Reserved.

Measured Success

- **We are typically conducting Level 5 SCAMPI appraisals in 5-6 days**
  - Based on over 20 SCAMPI A appraisals
  - 3-4 projects, 6-9 appraisers, 3 mini-teams, 10 hour days
  - Post-appraisal follow-up indicates >95% accuracy rate
  - Significant Cost savings
- **We are continuing to look at ways to decrease the preparation time**
  - Evidence notebook organization
  - On-line evidence